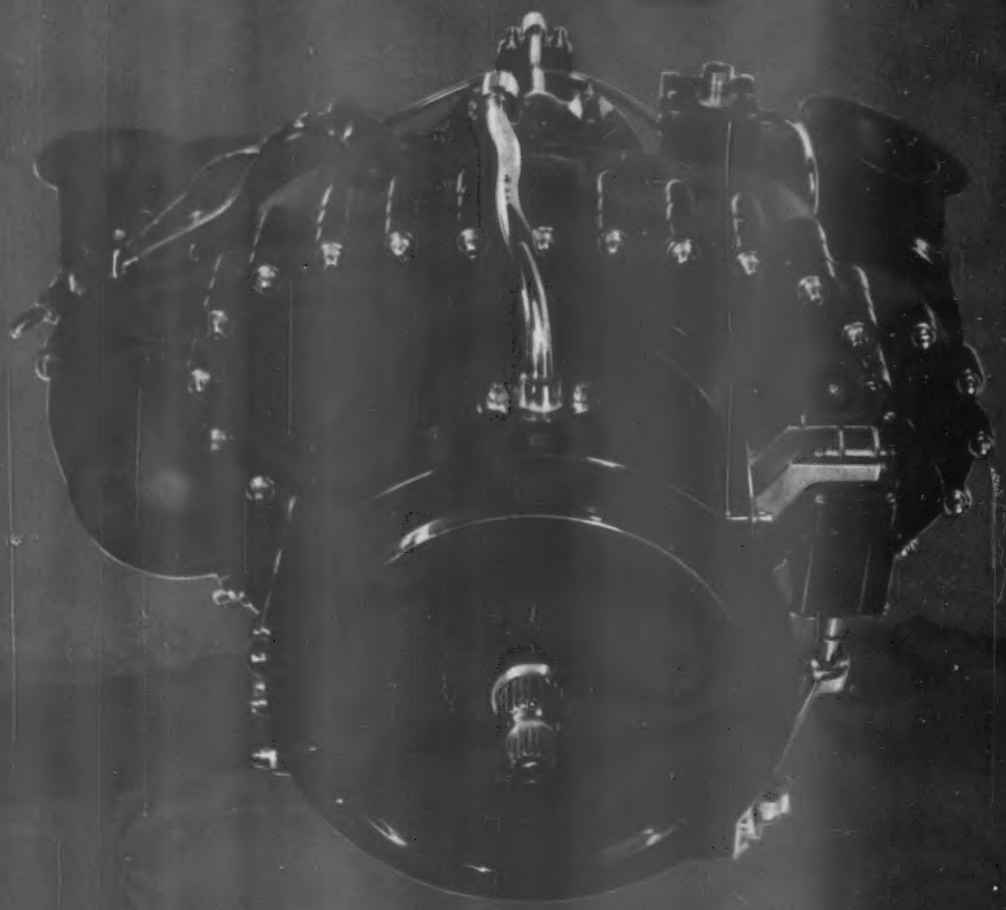
THE AEROPLANE and ASTRONAUTICS



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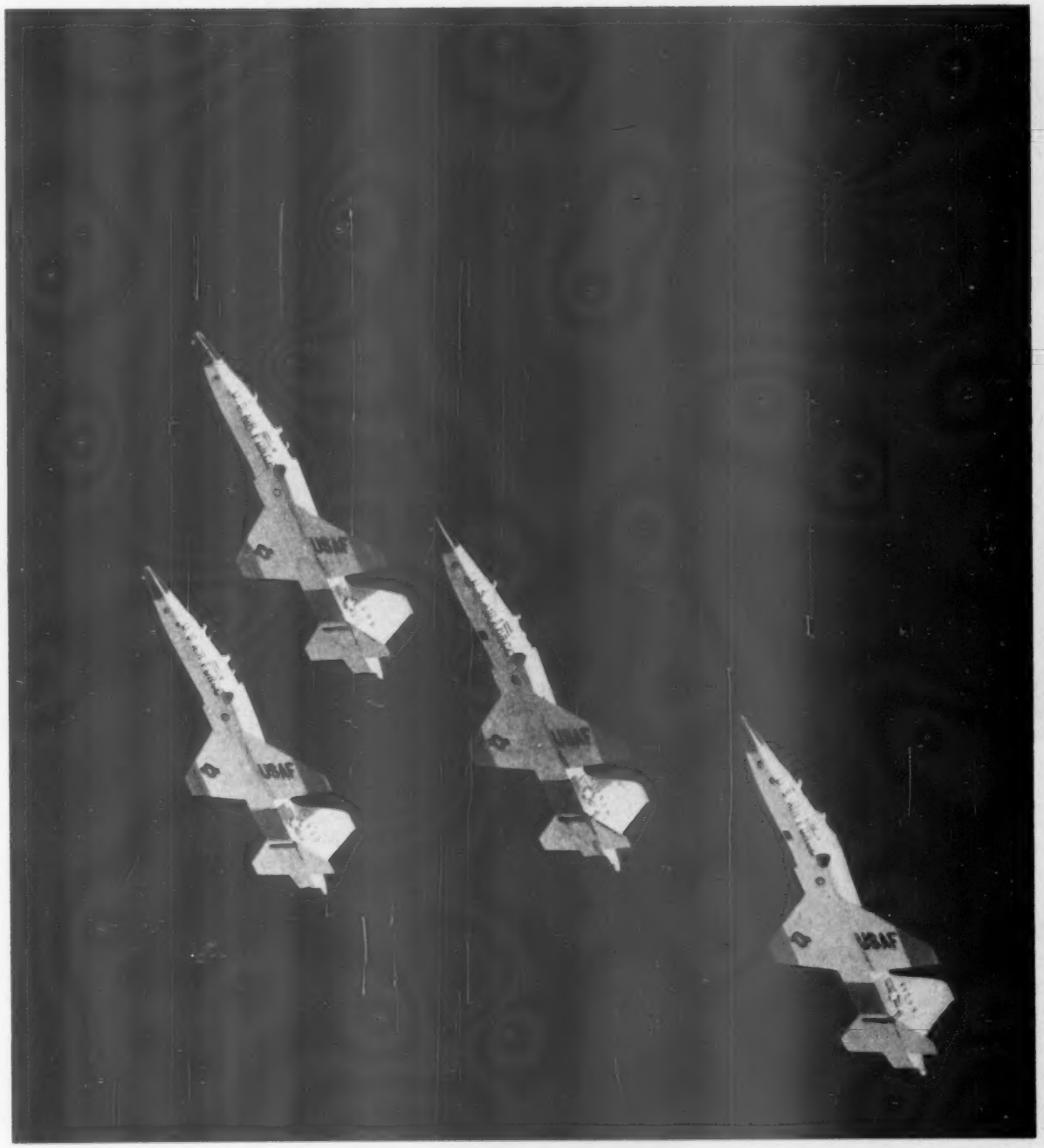

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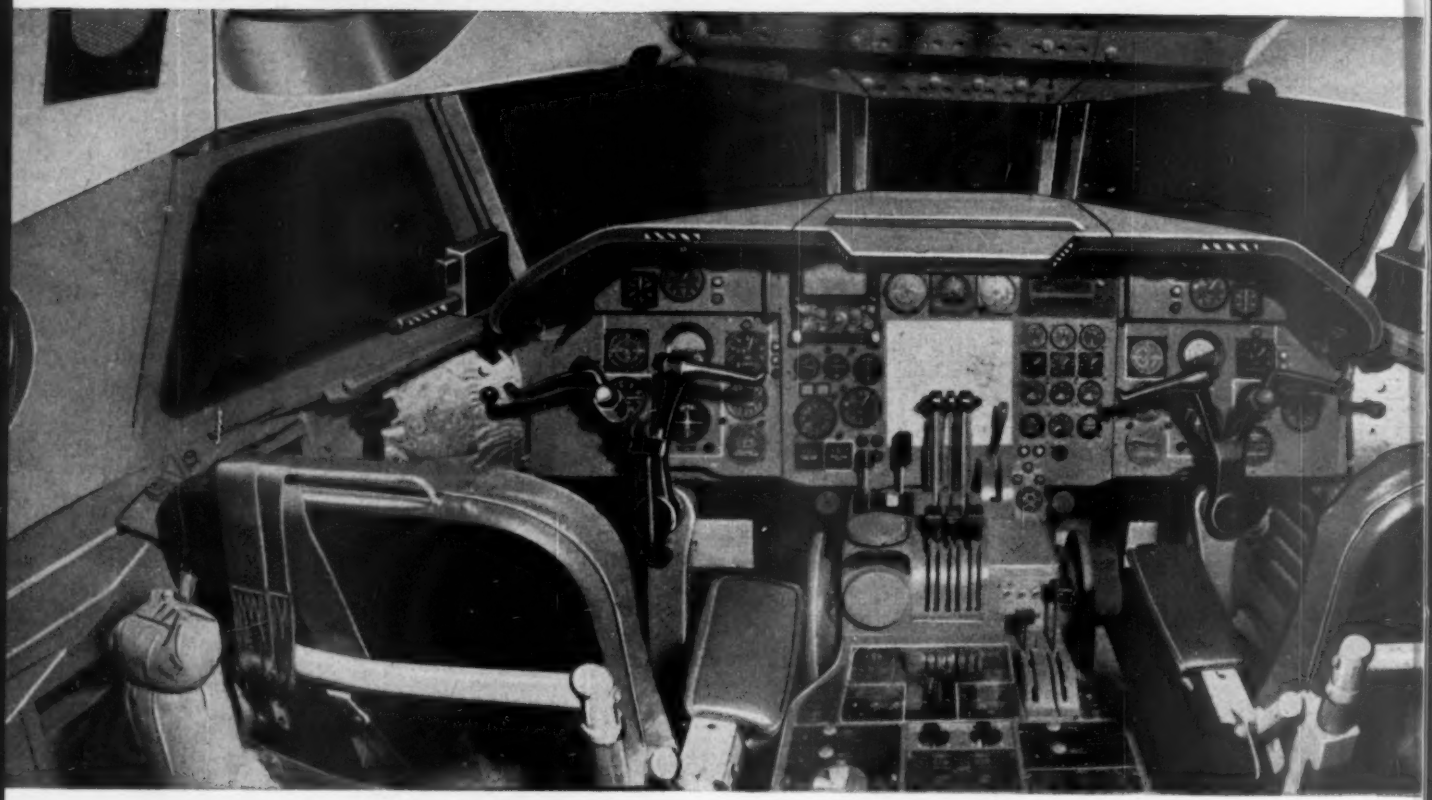

This is a mock-up of the BEA de Havilland 121 cockpit. Smiths equipment has been specified to provide automatic flare control when the aircraft enters service. Smiths S.E.P. 5 automatic pilot (the pilot's controller is in the bottom centre of the picture) operates on the Multiplex principle and will, ultimately, provide full automatic landing facilities to civil safety standards. Smiths Para Visual Director (P.V.D.), a revolutionary flight director display, can be seen around the panel coamings. In the D.H. 121 Smiths P.V.D. will operate in conjunction with the new Smiths integrated Flight System, specifically designed in conjunction with BEA to fit the 121's operational role.

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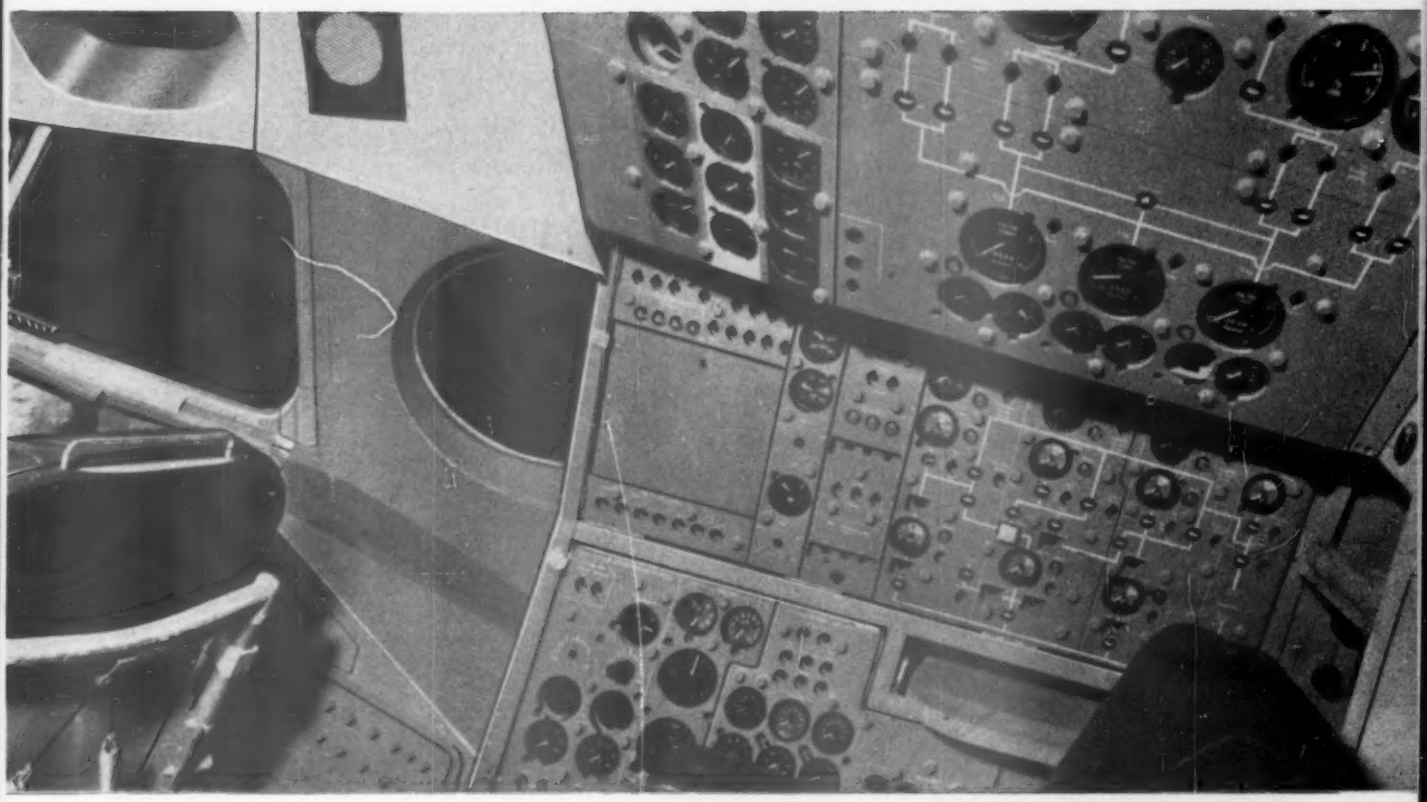

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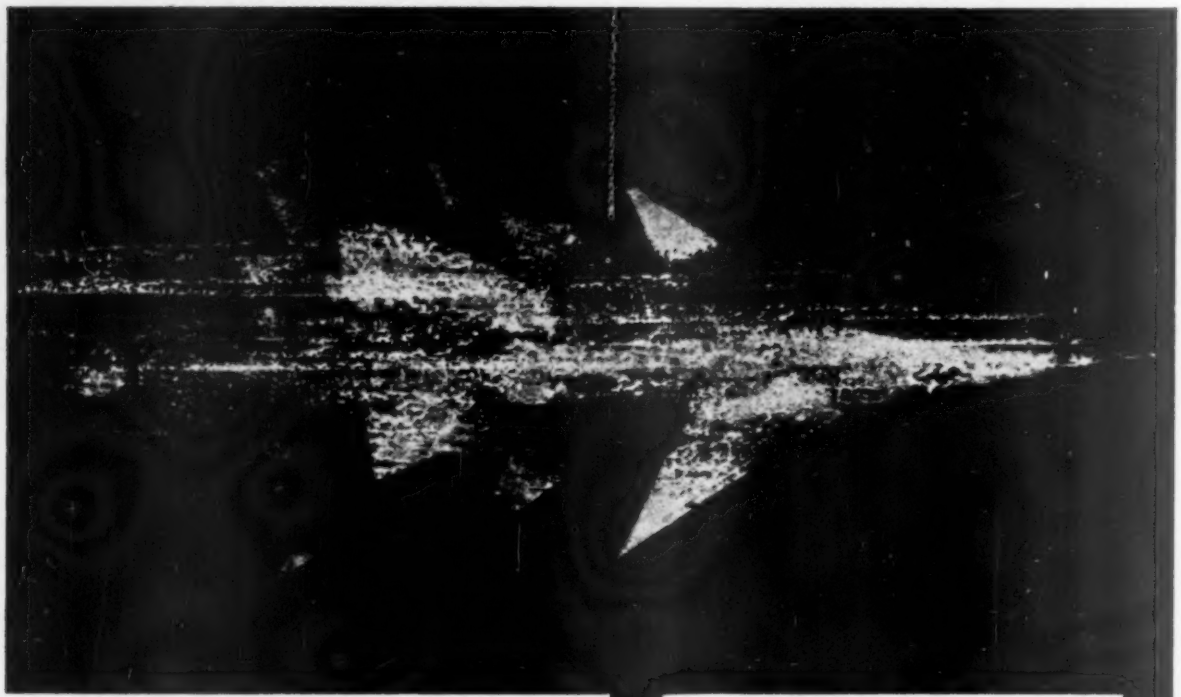

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THE AEROPLANE and ASTRONAUTICS

VOLUME 100 NUMBER 2569 JANUARY 13, 1961

An Unsatisfactory Explanation

Excepting the classic case of the Comet accident off Elba we imagine that in no other instance has an effort of such magnitude been made to recover aircraft wreckage from the bottom of the sea as was done with the Handley Page Victor which disappeared on Aug. 20 last year. A large proportion of the wreckage was recovered and pieced together at the Royal Aircraft Establishment. No official findings have yet been published.

In such circumstances we wonder whether the full implications have been considered of an item on the B.B.C. television programme last week when millions of viewers were told categorically, as it seemed to us, that one pitot head broke-off at the wing-tip of the unlucky Victor. The pilot in consequence thought he was going slower and slower. He therefore pushed the nose of the million-pound bomber downwards and dived into the sea. The name of Dr. P. B. Walker of the R.A.E. was so frequently mentioned that viewers could be excused for thinking that it was his explanation. We are sure it could not be. He would have known that air-minded viewers would want to know about the other flight instruments.

If the B.B.C. in their wisdom decide to give an entirely non-official explanation of an accident to an R.A.F. aeroplane, it ought to be made absolutely clear that in the absence of an official account of what happened, a guess on a completely individual basis is being made. In this particular case the old yarn of how for want of a nail a kingdom was lost seemed to have been adapted far too freely.

Accidents Analysed

At this time when the handling of aircraft and their control from the ground in relation to the airlane network are receiving unprecedented attention with a view to increasing safety, it is clearly important that analysis of accidents to civil aircraft should receive equally concentrated attention. Statistics from official sources by the very nature of the organizations gathering them are generally far from being up to date. For instance, it was only in the last days of December, 1960, that statistics for accidents to aircraft on the British Civil Register of Aircraft have been published for the year 1958.

So far as aircraft engaged on public transport in that year were concerned, the figures were not alarming, being 13 for notifiable accidents and six for fatal accidents, compared with the figures for 1957, which were 11 and seven respectively. It was in the sector outside this field that the figures were most unsatisfactory, being 119 for notifiable accidents and 19 for fatal accidents, as against 104 and nine for the previous year.

It will be some time before official figures for accidents to aircraft on the British Civil Register for 1960 are available, and who knows when ICAO will get around to releasing the World figures. We have therefore made our own compilation from particulars published regularly in *Lloyd's List*.

Analysis by categories shows that bad though the figure is for collision on descent or approach, it is nothing like as bad as the figures for take-off and landing. Indeed the figure for landing is the highest for all categories. It is quite clear that there is still a paramount need for an aeroplane that lands slowly.

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Founder Editor (1911-1939) *C. G. Grey*

Proprietors: TEMPLE PRESS LIMITED
Chairman and Managing Director:
ROLAND E. DANGERFIELD

Editorial, Advertisement and Publishing Offices:
BOWLING GREEN LANE, LONDON, E.C.1

Telephone: TERminus 3636
Telegrams: "Pressimus London Telex"
Telex: 23839

Annual Subscription Rate: United Kingdom £4 15 0
Overseas £5. Canada and U.S.A. $15.00

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Matters of Moment

More Space Talks

TECHNICAL missions from Europe and Canada were in Britain this week to inspect the Blue Streak facilities at de Havilland factories and the rocket engine test centre at Spadeadam, Cumberland. The visit was in connection with the project to develop Blue Streak as the basis of a European heavy satellite launcher.

European countries represented were Belgium, Denmark, Federal Republic of Germany, Italy, the Netherlands, Norway, Sweden and Switzerland. The object was to familiarize the various missions with the British technical progress in preparation for the conference which Britain and France are jointly sponsoring in the near future. French technicians carried out a similar inspection of the Blue Streak facilities some weeks ago.

Meanwhile, Mr. Peter Thorneycroft flew to Bonn on Jan. 10 for talks with Herr Straus, West German Defence Minister, and Dr. Erhard, Minister of Economics. He was due to leave for further discussions in Oslo, Copenhagen and Stockholm yesterday. Although the space-project was stated to be the principal reason for his visits, opportunity is also being taken to discuss other matters of mutual interest, particularly defence.

Next move in the plan to put Blue Streak to work as a space-booster will be to convene a meeting of senior ministers from interested governments with the object of reaching a formal agreement. It is possible that this stage will be reached early next month.

To Direct Engine R. and D.

MR. P. LLOYD, C.B.E., M.A., F.R.Ae.S., has been appointed director-general of engine research and development at the Ministry of Aviation. Until the end of 1960 he was deputy director of the National Gas Turbine Establishment.

Born in Sheffield in 1907, Mr. Lloyd was educated at Greshams School and Trinity College, Cambridge. Between 1929 and 1940 he worked as an industrial chemist. He then joined the air defence department of the Royal Aircraft Establishment and transferred to the engine department in 1941. In 1944 he joined Power Jets (Research and Development), Ltd., and in 1946 went to the N.G.T.E. where he became deputy director in 1950.

Viscount Spar Boom Mods.

SOME 80 early production examples of the Vickers Viscount 700 were affected by the maker's advice to operators on Jan. 8 to inspect wing joints within seven days and meantime to impose a speed restriction. The recommendation, made with the A.R.B.'s approval, followed the discovery of stress corrosion cracks in the spar booms of two of the four Viscount 748s in service with Central African Airways. The speed limitation, to 190 knots E.A.S., had comparatively little effect on most operators.

Cracks in the end lugs of a spar boom were discovered in one C.A.A. Viscount early last week, during routine inspection at Salisbury. A Vickers metallurgist flew out at once, and similar cracks were found in the second Viscount, also at Salisbury. Thereupon, C.A.A. grounded its other two Viscounts (one at Nairobi, one at Durban, on Jan. 8) and Vickers issued its advice to operators.

Inspection of the spar boom end fittings, top and bottom at the centre section/inner wing and inner wing/outer wing joints can be made *in situ* using ultrasonic test equipment. In those cases where such equipment was not locally available, Vickers was arranging this week to supply Solus-Schall equipment, of the type used at Weybridge, on loan.

The aircraft affected by this order are those having D.T.D.363 lower booms; later Viscounts have booms of L65 material. All Viscount spar booms are "lifed" components, the actual limit depending on the material and design of boom used. Over the past two years, many time-expired booms have been returned to the makers and thoroughly examined, but this particular type of cracking, the origin of which is at present obscure, has not previously been encountered. It is not, however, associated with fatigue, which caused the withdrawal from service for modification of a small number of Viscount 700s three years ago.

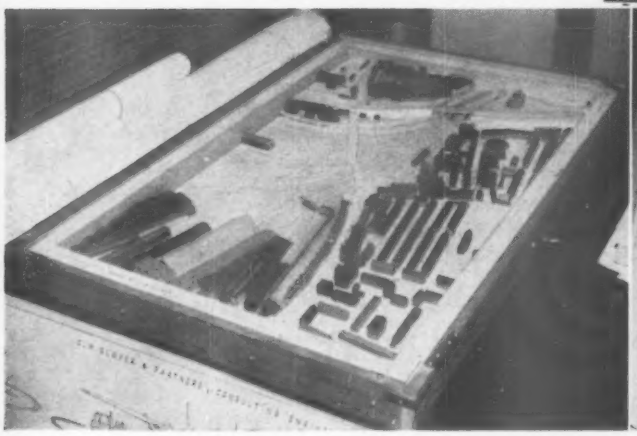
Sponsoring Helicopter Research

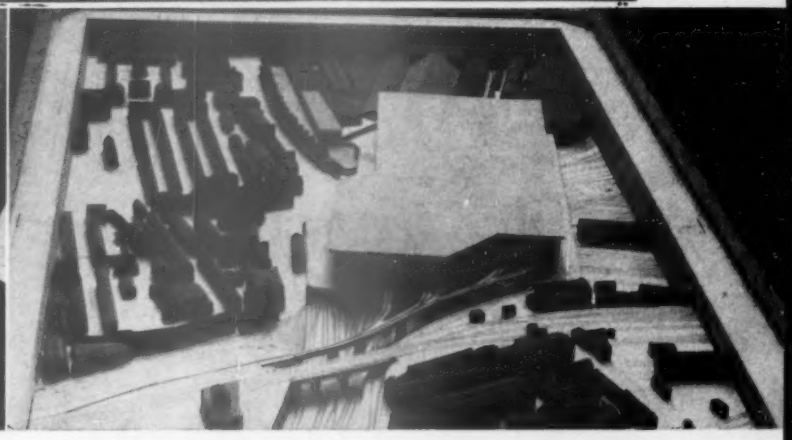
WESTLAND AIRCRAFT, LTD., has made a £17,500 donation to Southampton University to be used for the endowment of a readership in helicopter engineering. It is in the form of a seven-year covenant and will make possible basic helicopter research under Prof. E. J. Richards, professor of aeronautical engineering at the university The endowment was made following an expansion programme appeal by the university's chancellor, the Duke of Wellington.

In 1955, Westland contributed £3,500 towards aeronautical research and facilities at the university. This helped promote research into helicopter rotor-blade vibration and blade motion in forward flight. It has also been used to set up test units including a wind-tunnel and an acoustic laboratory. In addition opportunities have been provided for consultant work on blade-tip silencing with the Saunders-Roe and Fairey Divisions of Westland.

LIVERPOOL HAND-OVER.—As recorded on page 33, Speke Airport was formally transferred from the M.o.A. to the City Corporation on Jan 6. Below is the scene in the airport lounge, with Mr. Geoffrey Rippon, M.P., Parliamentary Secretary to the Ministry, addressing the guests; right is Wg. Cdr. H. Andrews, the newly appointed airport director; below right, Mr. Rippon and Ald. John Braddock (left), chairman of the Airport Committee, in the tower with Mr. Brian Nixon, A.T.C. officer, after the ceremony.

HELIPORT SCHEME.—As described on this page, a heliport forms part of a new scheme for a marketing centre to replace Covent Garden. It would be built on stilts over the railway lines to the north of King's Cross Station. The site is shown below, as seen from the south. The new market and its flat roof for a heliport, below right, are shown as they would appear from the north. On the right is a section through the proposed market.





Hawker Siddeley's New Board

FOLLOWING the Hawker Siddeley take-overs of the Folland, Blackburn and de Havilland companies, there have been additions to the board of Hawker Siddeley Aviation, Ltd. According to Sir Roy Dobson, this is a strengthening "aimed at the complete consolidation and integration of all the Hawker Siddeley Group's aircraft and missile interests into one solid and powerful organization."

Mr. J. T. Lidbury has been appointed chief executive of Hawker Siddeley Aviation, and its new board is: Sir Roy Dobson, chairman; Sir Aubrey Burke, deputy chairman; Mr. J. T. Lidbury, chief executive; Mr. J. A. R. Kay, sales director; Mr. S. D. Davies, technical director; Mr. A. S. Kennedy, finance director; Mr. H. Burroughes, Gloster Aircraft; Mr. J. F. Robertson, group finance; Mr. A. F. Jopling, Blackburn Aircraft; Sir Sydney Camm, Hawker Aircraft; Sir William Farren, missiles; Mr. W. S. D. Lockwood, Armstrong Whitworth; Mr. H. S. Sturgeon, de Havilland Aircraft.

Hawker Siddeley Aviation now employs a total of 73,300 people. Its main aeronautical subsidiaries are Sir W. G. Armstrong Whitworth Aircraft, Ltd.; Blackburn Aircraft, Ltd.; Blackburn Engines, Ltd.; de Havilland Aircraft Co., Ltd.; de Havilland Engine Co., Ltd.; Folland Aircraft, Ltd.; Gloster Aircraft, Ltd.; Hawker Aircraft, Ltd.; and A. V. Roe and Co., Ltd.

King's Cross Heliport

A NEW heliport for London forms part of an unofficial proposal for the relocation of Covent Garden market. Briefly, this scheme proposes that a complete new market centre should be built on stilts over the sidings to the north of King's Cross railway station and that the current site of the Covent Garden market should be redeveloped with blocks of flats and offices. The flat roof of the new marketing centre could be adapted for use as a heliport at a cost of less than £500,000 above the cost of the market centre itself, which would be about £6 million.

This scheme is more sweeping than the official proposals put forward for the future of Covent Garden. It is being sponsored by Mr. C. W. Glover, and a group of 10 major engineering companies which form the Industrial Development Group, Ltd. Mr. Glover is the senior partner of C. W. Glover and Partners, consulting engineers and architects.

The heliport proposal obviously depends on the adoption of the scheme for the marketing centre. Lord Sempill is sponsoring the helicopter scheme, which is being put forward by his company, Central Airport, Ltd. Twenty-seven years ago this company projected a roof-top aerodrome in the same area for use by fixed-wing aircraft.

Current proposals are for a heliport 1,200 ft. long and nearly 800 ft. wide, which would be 120 ft. above ground level. It would be very close to Euston, King's Cross and St. Pancras Stations. A main road, York Way, would run through the building supporting it.

The marketing centre and heliport could be built in about two years after the go-ahead was given. Westland Aircraft has been consulted about the design of the heliport.

Helicopter approaches would have to be made overland, and not over water as is the case when using the current Westland heliport. But the sponsors of the scheme expect that present restrictions will not apply to the operation of the new types of twin-engined helicopter.

Lord Terrington

THE loss of Lord Terrington, K.B.E., who died on Jan. 7 at the age of 73, is a severe one to air transport. Among his many duties, that as chairman of the Air Transport Advisory Council since its formation in 1947, and of its successor the new Air Transport Licensing Board, have been best known to those in aviation. His knowledgeable and just work on the A.T.A.C. received nothing but praise from air operators, whether successful in their applications or not.

There will be widespread regret among aviation people that this jovial Yorkshireman, of infinite patience, tolerance and understanding was not spared to ensure the smooth transition of the work of the A.T.A.C. to the new Licensing Board.

Lord Terrington—Horace Marton Woodhouse, third Baron Terrington of Huddersfield—succeeded to the title in 1940. He began the career for which he is best known—as a mediator in industry—when he was assistant secretary to the Ministry of Food from 1918 to 1921, though between 1923 and 1941 he was a practising solicitor. He became chairman of the National Arbitration Tribunal in 1947 after being a member since 1944. According to *The Times* he was responsible for more wage awards than any other man.

Matters of Moment . . . .

Nothing Succeeds Like Success

ANOTHER success for the Dassault Mirage interceptor and ground-attack aircraft has come close on the heels of an Australian order for 30 aircraft of this type. On Dec. 28 the Swiss Government announced that it proposed to buy 100 Mirage IIICs to be built under licence in Switzerland. The decision follows a competition between the Mirage and the Saab Draken for this order.

In the case of both Mirage orders it is possible that the aircraft will be equipped with Ferranti Airpass radar and, in the case of the Australian order, it is very likely, if development trials are successful, that the aircraft ordered will be powered by Rolls-Royce Avon RB.146 turbojets.

Guild Investments

AT a meeting of the Court of the Guild of Air Pilots and Air Navigators on Jan. 5, seven distinguished new Liverymen were invested with the Livery. The inclusion of Mrs. Brackley, widow of Air Cdre. H. G. Brackley, will be warmly welcomed by all who remember "Brackles," and who have read Mrs. Brackley's biography of this pioneer.

The other new Liverymen are Gp. Capt. G. F. K. Donaldson, C.F.I. at the C.F.S. in 1942 and now divisional operations officer for the M.o.A. Northern Division; Capt. Alan Duckworth, a B.E.A. captain; Air Cdre. Sir Edward Fielden, Captain of the Queen's Flight; A.C.M. Sir Leslie Hollinghurst, air member for personnel at the Air Ministry from 1949 to 1952; Capt. V. A. M. Hunt, director of aviation control and navigation development and planning at M.o.A., and Capt. B. A. Powell, a B.U.A. captain.

Lightweight Italian Jet

FLIGHT testing of a new Italian jet aircraft, the Procaer Cobra F.400, began last November. A two-seat jet trainer and tourer, the Cobra is powered by a 400-kg. (880 lb.) thrust Turboméca Marboré. It was designed by Ing. Stelio Frati and built by Societa Procaer of Milan as a private venture. It has side-by-side seating and a retractable tricycle undercarriage. Air and wheel brakes, flaps and undercarriage are hydraulically operated.

As a military aircraft the Cobra will be offered as a basic trainer and for communications duties. It is fully aerobatic. Production aircraft would be powered by a higher thrust turbojet of 1,060 lb. thrust. They would be faster than the prototype and have a three-hour endurance and a 930-mile range.

The prototype has a span of 28 ft. 6 in., a height of 9 ft. 3 in. and a length of 25 ft. 8 in. Empty weight is 2,320 lb. and maximum take-off weight 3,860 lb., or 3,420 lb. for aerobatic flight. Its cruising speed is about 292 m.p.h.

Rotor Blades among the Sails

ALTHOUGH one does not normally expect to find anything of direct aeronautical interest at the (now) International Boat Show, there is this year another glimpse of rotary-wings among the masts and sails. Sabre Speedcraft, Ltd., have under development a one-man rotor "kite" to be towed behind a fast boat. As a technical novelty this is of interest; but at £450 it would seem to offer a very expensive alternative to water ski-ing.

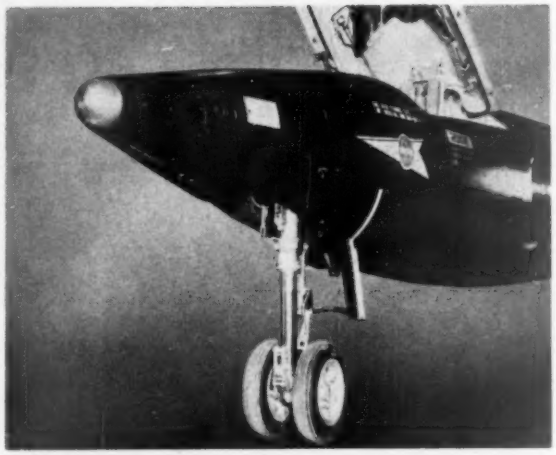
A large part of this cost is, we understand, accounted for by the rotor hub and blades—which are Bensen Gyrocopter units. It is possible that this might be reduced in production runs; but the structural integrity of these units plays so essential a part in ensuring the safety of the occupant that obviously there can be no scrimping or over-commercialization of the components.

The Sabre rotor-kit comprises little more than a pair of glass-fibre floats, a seat, a control column, and a two-bladed pylon-mounted rotor. Spreaders for the floats are in the form of duralumin channel-section members faired with wrapped light-alloy sheet. Between the front and rear spreaders is a pair of fore and aft channel members on which are mounted a floor, the seat, a footrest and a normal aircraft-type control column.

Four more faired channel members, in the form of a quadripod, provide a mounting for the tilting rotor head. And a simple system of bell cranks and push-pull rods connects the head to the pilot's control column.

So far only initial experiments have been made at Brightlingsea with this little rotor kite. It weighs 140 lb. unoccupied and needs a fairly powerful speed-boat to tow it—something of the order of 36 h.p. is required. It becomes airborne at about 22 m.p.h.

This device appears to be the modern equivalent of the wartime rotary-wing observation kites developed by the Germans for towing behind submarines. It will be interesting to see whether its possibilities as a new pastime for the waterborne thrill-seekers will be developed. One thing, at any rate, is clear—with downwash added to water wash and an airborne as well as a surface hazard to keep clear of (despite the stated rules) the sailing fraternity is not likely to welcome unrestrained enjoyment of this particular development.—F.T.M.



HOT NOSE.—Replacing the pointed nose used in earlier test flights, this X-15 research aircraft has a new "Q-ball" nose developed by Northrop Corporation. Device will sense angles of attack and side-slip during exit and re-entry phases of hypersonic flight.

A Sad End to a Sad Story

TOWARDS the end of this month tenders are to be invited for the sale of the three Saunders-Roe Princess flying boats and their ancillary equipment. This follows the announcement on Dec. 5 by Mr. Thorneycroft, the Minister of Aviation, that he proposed to offer the Princesses for sale on the open market.

The War Office Director of Disposals will handle the sale. Selling the flying-boats in this way suggests there is little hope

TRAINER FROM MILAN.—Powered by a Turboméca Marboré turbojet, the Italian Procaer Cobra prototype is now undergoing its flight test programme. It is a two-seater and cruises at 292 m.p.h.

that they will be bought other than for scrap. One scheme to use them for services between Britain and America was described in our Nov. 25 issue.

The question of what was to be done with these lovely craft came up in Parliament on Dec. 5 last, prompted perhaps, by the report published in this earlier issue, of the registration of British Princess Flying Boats, Ltd., expressly to treat for their purchase. The company is prepared to buy only so long as it can also acquire guaranteed rights to operate over certain routes. In all the circumstances, that is an eminently reasonable stipulation.

In reply to MR. J. RANKIN (Lab., Govan), the Minister of Aviation, Mr. Peter Thorneycroft, confirmed that the flying-boats are for sale, but Mr. Rankin then went on to invite the Minister to turn down any offer with route-rights attached, on the score that provision of such rights is the business of the Air Transport Licensing Board. To which the Minister replied that he thought "there would be some difficulty with a composite contract of that character," but, in answer to MR. J. M. HOWARD (Cons., Southampton, Test), he invited a further Question on the Order Paper regarding proposed routes.

The history to date of the Princess enterprise can be stated in one sad sentence. The three boats were ordered, built, paid for, hailed with a flourish of trumpets and then put aside to wait for engines—in which sorry state of idleness they have remained for six long years.

To be completely realistic, this fate was settled when the decision was taken to give thé Britannia's need for Proteus engines priority over the Princesses. Today, to be any good, the Princess boats need Tyne engines and nobody can be found to provide the cost of putting them in.

Rocket Propulsion Debated

WITH the distinction of being the first U.K. symposium devoted purely to rocket propulsion, the Cranfield conference on Jan. 6 and 7 was intended as a survey of British work in this field. It was organized jointly by the Royal Aeronautical Society, the British Interplanetary Society and the College of Aeronautics, and was planned by a representative committee under the chairmanship of Prof. A. G. Smith, until recently Head of the Department of Aircraft Propulsion at Cranfield and now Hives Professor of Thermodynamics at Nottingham University.

The programme included 17 papers and the delegates numbered more than 100.

In his welcoming address given in the absence of the Principal, Prof. J. A. J. Bennett pointed out this was an all-propulsion symposium whereas the previous joint symposium at Cranfield, in 1957*, had been concerned with all fields of rocketry. He said it was hoped to hold further annual conferences which would be devoted to other aspects of propulsion—for this reason this one was limited to the two main topics of controllability and reliability.

As was to be expected from a subject with so many controversial features there was a good deal of evidence of these during the discussions. For example, propellents versus nitrogen for servo operations; single-chamber versus multi-stage configurations; transducers versus Bourdon gauges; digital electronic computing of test results versus visual inspection; flow turning versus welding; and of course liquid propellents (not forgetting packaged ones) versus solids, were all debated. The question of the correlation between the number of parts and reliability also came in for a good deal of attention.

An interesting appeal was made for more attention to be paid to the control of mixture ratio and residual throughput. The propellent unused at burn-out could, it was explained, be more than the payload and often the engine "tail off" lasted several minutes.

Dr. I. E. Smith of Rolls-Royce, in reply, said the propellent left was a matter of the accuracy of filling the tanks as well as calibrating the engine.

The same speaker was asked about pressure transducers which obviously give high readings because of the long lengths of pipe required when dealing with cryogenics. He replied that special transducers were available for overcoming this but they cost 10-20 times the normal amount. Another speaker observed that engines were sometimes developed in spite of instruments rather than because of them—a theme which was repeated in the reliability discussion.

Prof. Murphy expressed admiration for Bristol Aerojet for regularly producing rocket cases with an ultimate tensile strength of 120 tons/sq. in. As a metallurgist he felt that this was no mean achievement.

Mr. S. L. Bragg of Rolls-Royce concluded his lecture with the comment: "The fact is that the exacting conditions of rocket operation exaggerates the slightest imperfection in an engine design, and only the bravest designers dare to compete with such a formidable challenge." It was, in fact, unanimously agreed that starting and stopping were the most hazardous phases of liquid motor operation.

* High Altitude and Satellite Rockets Symposium, Jly. 18-20, 1957.

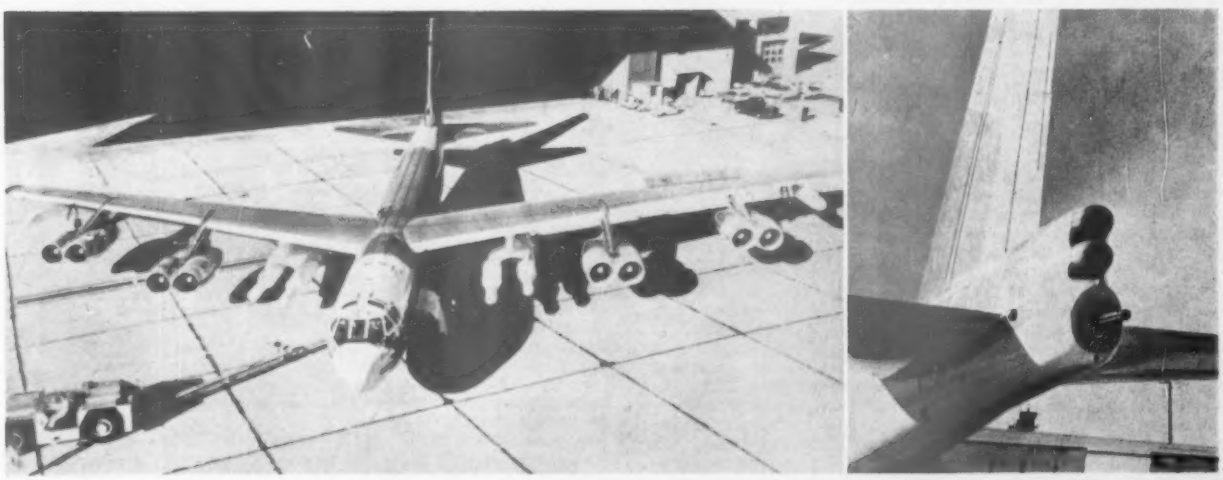
Tynes for the Transall

LAST Monday the German Defence Ministry announced in Bonn that Rolls-Royce had been given a contract to supply Tyne turboprops for three prototypes of the Transall C-160 military transport. The order is worth DM 10.5 million (about £875,000).

This aircraft is being developed jointly by France and West Germany. It is a twin-engined high-wing military transport of 90,390 lb. all-up weight which will be powered by two 6,020-e.h.p. Tyne RTy.20 turboprops. Its maximum payload will be 26,445 lb., and it will carry a 17,640-lb. load over a still-air range of 2,800 miles. Cruising speed will be 311 m.p.h.

Weser Flugzeugbau is responsible for overall management of the Transall project and is also producing the rear fuselage and tail unit. Nord Aviation is manufacturing the wing and will also assemble and test-fly the first prototype. Its first flight is expected is mid-1962. Hamburger Flugzeugbau is building the front fuselage. The second and third prototypes will be assembled in Germany.

West Germany has a requirement for about 200 of these aircraft. It is possible that Tynes for production aircraft will be built in France by Hispano Suiza, which has an agreement with Rolls-Royce for joint production of this engine.



DUMMY RUN.—The first Boeing B-52H bomber was rolled out at Wichita on Jan. 5. This aircraft will be used for Skybolt compatibility tests and carries four dummy missiles; it is powered by Pratt & Whitney TF-33 turbofans. For defensive armament there is a six-barrelled 20-mm. Gatling gun in its tail (right).

Matters of Moment . . . .

New Aids for Landing-on

TWO recent developments in approach and landing aids for Royal Navy aircraft carriers are the deck landing projector sight (D.L.P.S.) and a long range visual landing approach aid known as Hilo.

Designed to overcome the limitations of the mirror landing aid, which has been in service since 1954, the projector sight is to be fitted to all carriers. Two of these new visual landing aids were installed in H.M.S. "Ark Royal" in December, 1959.

In the projector sight there is a vertical optical system of 12 units in place of the curved mirror and its battery of four lamps of the earlier aid. This produces a yellow spot instead of the white light "ball" of the mirror. The horizontal green datum lights have been reduced in number to three each side of this vertical optical system, but the two red "wave-off" lights remain as before.

As with the mirror aid, the basic procedure for the pilot is to make the yellow spot produced by the vertical light system coincide with the green light bar, so that the correct preset approach and landing path is maintained. The height of the datum lights above the flight deck is varied according to the hook height of the aircraft making the approach.

The maximum range that the glide path indications of a mirror aid or projector sight can be used under normal conditions is not much more than 1 n. mile, and to improve this figure Hilo has been introduced. Fitted as a single installation in the carrier "Albion" for the past 12 months, this approach aid has been found to have, in good visibility, a range of 4 n. miles by day and 10 n. miles by night. It also has an average light beam of 8° in the vertical plane compared with 1½° projection of the mirror aid.

The Hilo system is based on the R.A.E. two-colour visual glide-path indicator unit. This contains three sealed-beam lamps producing a beam of light 8° in depth and 30° in width, with a red filter making the lower half of the beam red. Between the red and white sections there is a ½° band of pink light.

Each complete Hilo installation consists of a bank of four of these R.A.E.-type indicator units, mounted one above the other, so that an angular spread of approximately ½° is produced between the beams of light. Appearing as a single light source at long range, the four indicator beams show up to the pilot as a red bar of light if his aircraft is too low and as a white bar if it is too high. Nearer the carrier he can see the ½° band of pink light if he is within the correct approach-angle limits.

In normal conditions only a carrier's mirror aid or projector sight is used for landing, and in "Albion" the single Hilo installation has been mounted on the stabilized platform of the starboard landing aid. Hilo is expected to be used in conjunction with the projector sight to provide all carriers with a combined pilot visual approach and landing system.

A Well-earned Award

MR. TOM BROOKE-SMITH, until recently chief test pilot at Short Brothers and Harland, Ltd., has been awarded the new Founders' Medal of the Air League of the British Empire. This award was made "for the most meritorious achievement in the whole field of British aviation during 1960." It recognizes Mr. Brooke-Smith's contribution as test pilot of the SC.1 "which at Farnborough last September gave the first public demonstration in the World of both vertical take-offs and landings, by means of direct lift, and transitions between hovering flight and winged flight. . . ."

The Founders' Medal has been presented to the Air League by Mr. Stephen Marples who, with Col. H. S. Massy, founded it in 1909. The medal will be awarded annually.

Pests—and Parish Pump Politics

JUST about two thousand years ago the glory that was Greece crumbled away. Many theories, political, economic and spiritual, have been advanced down the centuries to explain the collapse of that wonderful civilization. It is now thought that a major contributory cause was Anopheles, the malaria-carrying mosquito, and that the resultant fevers sapped the strength of the Greeks. That so insignificant an insect could be so deadly has only been realized in recent times. In Central America the mosquito delayed the building of the Panama Canal more effectively than could armies of wild Indians, and only when the real enemy was recognized and dealt with could the construction begin.

Some two years ago I came across a most worth-while effort in Portuguese East Africa. At Beira the members of the local flying club put in their flying hours in the early morning before the thermals and heat of the day, combining this with aerial spraying of the fever-ridden creeks and swamps round the harbour and along the coast.

The whole history of Africa south of the Sahara could be written round the tsetse fly. It positively controls 4,000,000 (four million) square miles of what could be rich productive agricultural and grazing land, capable of supporting millions of people. For countless centuries it has controlled the migration of tribes and their use of domestic animals. That is why draft horses and oxen were unknown there. The habitat of the tsetse makes it more difficult to attack than the mosquito, since it lives and breeds mostly in the shade of the savanna scrub in warm, moist places. It does not migrate and cannot travel more than a few hundred yards in bright sunshine out of the protective shade of the undergrowth and trees. Any aerial attack must therefore be such as to penetrate the canopy of the scrub. We made an effort some years ago to drop insecticidal smoke canisters on parasheets, with time-delay fuses set to go off during the temperature inversion which always occurs at dusk and dawn. The number of canisters needed to give an adequate lethal coverage and the cost of the time fuses made the process uneconomic, so a cheap, simple, method is still needed.

The locust is a curse which has been known since Biblical days. It is not subtle and does not transmit disease by taking blood meals from humans. It simply eats every green thing in its path and it migrates in huge clouds, hopping or flying according to its age and growth, leaving famine behind it. I have talked to pilots who have flown Rapides and Tiger Moths throughout the daylight hours over the top of a vast cloud of locusts, spraying them with benzene hexachloride in an effort to stop them reaching the rich farmlands on the lower slopes of Kilimanjaro. They succeeded and the locusts dropped dead in millions, to be scooped up and toasted on iron sheets over charcoal fires by Africans, who regard them as a delicate change in their monotonous diet of mealies and bananas. I hope that the heat of the toasting volatilized the BHC. But locust cloud still follows locust cloud as the crops grow up again.

Though something has been and is being done, the surface of the subject has only been scratched. With all this in mind, I was excited last year when I heard that the International Agricultural Aviation Centre was to hold its first conference at Cranfield. I was not able to attend myself, but, not so long ago, I received the Proceedings in a bound volume of over 400 pages, containing the texts of nearly 60 papers which were read there and of the discussions which followed them.

It proved a bitter disappointment to me. It is true that some of the fundamentals of crop spraying and top dressing were stated. The talks ranged over the chemistry, physics, economics, flying operations, airworthiness and equipment as applied to Kentish orchards, East Anglian potato plots and the like. The New Zealanders spoke of their successes, but there was exactly nothing about South America, Asia or Africa where the conditions are entirely different, and where starving millions live in a state of perpetual famine whilst the insects thrive. We may read in the proceedings about droplet sizes in microns, but let us turn from the globular to the global scale of thinking.

One speaker at the conference, Mr. D. B. Carter, of Haywards Heath, raised his voice in this sense and I will quote him:—

> "If in the underdeveloped areas, within the scope of an economic assistance programme, the fields of the native farmers are fertilized from the air, and thus regain their fertility, the apathy will disappear and human energy will be liberated. . . .
>
> "For the first time we have a central organization at our disposal drawn from every part of the World. How are we going to use it? Simply to increase our riches? Or do we set out to see what can be done to help a World sickened with hunger?"

Sir Miles Thomas, in his opening review, also spoke in this tone and showed his breadth of vision. But the conference as a whole did not follow these vital leads and gave no hint of any solutions to World problems, if indeed they gave them a thought in their inner minds.

We, in aviation, must think big and not fence ourselves into little fields. There is work for designers, engineers and constructors, for pilots and operators by the thousand. This is the Wind of Change which is needed in Africa, not the pompous outpourings of politicians, white or black.

MARCUS LANGLEY.

Air Transport

Vanguard Continues

BRITISH AIRCRAFT CORPORATION officials flatly denied on Jan. 9 the truth of a report in that day's *Daily Mail* to the effect that production of the Vanguard was to be terminated with the present orders. The company is "actively pursuing further sales" of this low-cost turboprop transport, and will continue to do so so long as the jigs are on the floor. Deliveries of the 43 Vanguards to B.E.A. and T.C.A. will continue into 1962.

The point at which further orders for the Vanguard cease to be acceptable depends primarily on the floor space available at Weybridge for other projects. If the VC-11 and BAC-107 go ahead, or large new orders for the VC-10 are obtained, the present situation may change but, even so, ample room is available at Filton for production of some of the new projects, and it is part of basic B.A.C. planning that work on the VC-11 and BAC-107, in particular, should not be concentrated at Weybridge.

Speke for Liverpool

LAST Friday's formal transfer of Liverpool Airport from the Ministry of Aviation (by Mr. Geoffrey Rippon, the Parliamentary Secretary) to the City Corporation can be considered as being symbolic of a change in policy. During most of the years since the War the Government has not only preferred to remain in full control of all the important U.K. airports, but has thought in terms of traffic, or "catchment," areas, with master airports to serve these areas.

Speke Airport has suffered from route-right starvation because of its position of inferiority in relation to Ringway—though Liverpool has, in fact, a bigger nominal population than Manchester—and it was only five years ago that a direct service to London was licensed. Now that the traffic-area policy has been changed and, paraphrasing Mr. Rippon's words, local responsibility is being encouraged to meet local needs, there may well be developments.

Judging from some of the comments made in speeches during the handing-over ceremony at Speke last Friday, the Liverpool Corporation has no illusions about immediate profitability—the chairman of the Airport Committee (Ald. John Braddock) is also the chairman of the City's Finance Committee—but has no doubts about the need for Liverpool to maintain control of its own airport.

Overall, the onlooker might consider that Liverpool has got the best of the bargain. The Corporation now owns the airport (which has been under requisition since 1939) with the runways, lighting and operational equipment provided by different ministries during two decades and must pay for its management, but for the next seven years the M.o.A. will continue to provide staff and equipment for all necessary operational facilities.

Speke was laid out by the Corporation and licensed as an aerodrome in 1930; it became a public Customs aerodrome in 1933 and the present terminal buildings and main hangars came into use in 1939. Runways were laid down during the War (two are at present in use) and have since been strengthened and there is Calvert line-and-bar approach lighting. The main runway (5,127 ft.) has a hard-core overrun which can be used for a future 500-ft. extension.

Year-round scheduled services are operated to The Isle of Man, Belfast, and Manchester by B.E.A., to Dublin by Aer Lingus and to London by Starways, who also, with Cambrian, B.K.S. (Dublin vehicle ferry) and Dan-Air, operate seasonal services. Starways, in addition to a vigorous series of non-scheduled and freighting flights, operates all inclusive tours out of Liverpool and has made a feature of services to Lourdes. The load factor on the daily London service is high even in the winter months, and there are obvious prospects for its further development, using bigger-capacity aircraft.

A Compromised Freighter

AN all-cargo aircraft designed to fulfil the needs of both U.S. military and commercial operations is to be developed under a U.S.A.F. programme jointly initiated by the U.S.A.F. and the Federal Aviation Agency. This programme, which is expected to lead to a flying prototype within about two years, is regarded by the F.A.A. as "a significant step towards the promotion of air commerce by providing a specially designed, efficient cargo aircraft for domestic and international cargo services." Whilst the development will be financed by the U.S.A.F. as part of the MATS modernization programme, the aircraft will be designed for immediate certification for commercial use, with the second prototype allocated for F.A.A. certification trials. A total of $30 million has been appropriated for expenditure on the project to June, 1961, with additional financing to be included in the fiscal 1962 budget.

The specification requires the aircraft to be turbofan-powered, with truck-bed height loading and provision for air dropping of paratroops and supplies in the military version. Maximum payload is to be 70,000 lb., with the ability to carry 20,000 lb. across the Pacific and 50,000 lb. across the Atlantic. At max. gross weight it is to operate from 6,000 ft. runways.

Bids for prototype construction are now being sought from the U.S. industry. Among the principal contenders will be Boeing with their Type 731 (briefly mentioned in our issue of Dec. 2, page 734 and already in mock-up form), Douglas, Lockheed and Convair. The specification, as we recorded in our Oct. 14 issue, is known as SR182, and is distinct from the interim MATS requirement which is expected to be met by a version of the Boeing 707, KC-135, Douglas DC-8, Lockheed Super Hercules or Canadair CL-44.

The attempt to combine, in SR182, the requirements of military and civil operators is interesting and, although it will have the advantage (a very big one) of developing a civil pure freighter at military expense, must inevitably call for some design compromises in meeting two rather different specifications. Many airlines with growing freight traffic will certainly be watching development of this new aeroplane very closely indeed.

After the New York Collision

TWO policy changes, one major and one minor, have followed the collision disaster over New York. First, there is now, it appears, no serious airline resistance to the long-considered proposal, by the Federal Aviation Agency, that Distance Measuring Equipment should be mandatory for all civil transport aircraft—starting with turbojets.

According to *Aviation Week* airline support for the proposed DME action has been partly the effect of a growing belief that the collision may have been the result of an error in navigation—possibly by the failure of one of the DC-8's two VOR omni-conversion units. If the DC-8 pilot had only one operating VOR, it is thought that he might accidently have tuned to the wrong VOR station when fixing his position.

If this error was made, the pilot might have thought he was approaching the Preston fix when, in fact, he was 10 miles beyond this point. The DC-8's VOR receiver and its tuning head, both recovered from the crash, may provide evidence to support or refute this theory. The pilot of an aircraft equipped with DME obtains a direct reading of his position along the airway from the Vortac station whose radial he is flying. This provides a more precise fix than is possible using radials from two VOR stations.

Second, the F.A.A. has abandoned its practice of clearing turbojet transports inbound to Idlewild Airport along the "corner-cutting" route followed by the DC-8. Pilots have previously argued that turbojets, accelerating in the descent from cruise altitude along Airway Victor 30, were forced to make a 116° course change while only two or three minutes from the Preston intersection at which they must hold. The new routeing takes them a longer way round and gives them more time.

The first days of the public inquiry, which started on Jan. 4 in Brooklyn, have served to help to piece together the evidence provided by the A.T.C. transcript and have also produced some doubts about the altitude (assumed to be about 5,000 ft.) at which the collision occurred. Eyewitness accounts, even from specialists, concerning the height of aircraft are usually of doubtful value and too much should not, perhaps, be made of the fact that the majority estimation of the collision height lay between 1,500 ft. and 3,200 ft.

As the transcript showed, at 15.33 : 20 hrs. G.M.T. the N.Y. Air Route Traffic Control Center told the DC-8 to contact Idlewild Approach Control. At 15.33 : 28 the DC-8 was in touch, saying that it was approaching the Preston holding point at 5,000 ft. The time of the collision, to the north-east of Miller Field, Staten Island, and 11 miles from the Preston stack, was estimated by the investigators to be 10 33 : 42—or only 14 seconds later. At that moment Approach Control was still giving weather and other information to the DC-8—a message to which there was no reply.

There was some criticism at the inquiry of the fact that there was a gap, however short, between the cessation of control of the DC-8 by the N.Y. Center and contact with Approach Control. The transfer should, it was thought, be more positive. Questions about the continuity of radar tracking were asked, and answered by the statement of fact that the present A.T.C. system was not capable of maintaining complete and continuous radar surveillance and that the system required pilots to follow traffic instructions.

Air Transport . . . .

A Review of Accidents in 1960

IN the tabulation below will be found details of all the accidents to civil transport aircraft in 1960 which involved passenger or crew fatalities, plus a number of others which, although not fatal, caused the destruction of the aircraft or were of special interest. The total number of persons killed in these accidents or as a direct result of them was at least 1,360. The tabulation is based primarily on reports appearing in *Lloyd's List*.

Accidents to 82 transport aircraft are listed. Of these, 38 involved passenger fatalities while flying on scheduled service, including one known accident to an Aeroflot Il-18. Since air transport statistics for the U.S.S.R. and China are not available and it is assumed that other accidents may have occurred, but were unreported, it is usual to exclude these countries from accident statistics. In the 37 fatal accidents (excluding the Il-18) on scheduled service, some 880 passengers were killed (the exact total is uncertain since some reports do not distinguish between passengers and crew). This total, related to ICAO traffic statistics for 1960, indicates, as we reported last week, the very poor fatality rate of 1.27 passengers per 100 million passenger-miles—the worst since 1954.

A study of the tabulation—which includes 20 accidents to aircraft not on scheduled passenger operation and 24 in which no fatalities occurred—shows the following geographical division of the fatal accidents on scheduled services.

	Number of Aircraft	Passengers killed
North America	10	335
Central and South America	14	300
Europe	6	111
Asia	4	45
Australasia	2	32
Africa	1	55

The preponderence of accidents on the American continent can be attributed partly to the weight of air transport movements in the area, and the safety record, at least in the U.S.A., is not as bad as might appear at first sight. Regional traffic statistics for 1960 are not yet available, so it is difficult to calculate accident rates. The number of passengers killed in the U.S.A. (including Alaska) in accidents to scheduled domestic operators, at 332, compares with previous worsts of 199 (1947) and 198 (1959) and represents an estimated fatality rate of 0.96 passengers per 100 million revenue passenger-miles, the worst since 1951. But in Europe the 11 major carriers who are members of the Air Research Bureau suffered four

AIRLINE	AIRCRAFT	DATE	PLACE	CASUALTIES		REMARKS
				Killed	Survived (including injured)	
†Indian Airlines	DC-3 (VT-CGG)	Jan. 3	Taksing, India	8C	None	Hit mountain on food-dropping mission.
B.E.A.	Viscount (G-AMNY)	Jan. 5	Malta	None	All	Brake failure while taxiing. Hit control tower and destroyed.
National Airlines	DC-6B (N8225H)	Jan. 6	Bolivia, N.C.	29P, 5C	None	Sabotage; bomb exploded on board.
United Air Lines	DC-8	Jan. 6	Buckley Field, Denver	None	All	Emergency landing after "hydraulic trouble"; all tyres burst and aircraft left runway.
B.E.A.	Viscount (G-AOHU)	Jan. 7	London Airport	None	All	Heavy landing. Nosewheel collapsed. Aircraft burnt and destroyed.
Capital Airlines	Viscount (N7462)	Jan. 18	Holdcroft, Va.	46P, 4C	None	Mechanical or structural failure in flight?
S.A.S.	Caravelle (OY-KRB)	Jan. 19	Ankara	35P, 7C	None	Hit hill on approach. Altimeter misread?
Avianca	L-1049G (HK-177)	Jan. 21	Montego Bay	35P, 2C	9	Burnt after heavy landing. Pilot error caused by fatigue.
Transportes Aeros de Timor	Heron (CR-TAI)	Jan. 26	North of Darwin	7P, 2C	None	Disappeared at sea.
T.W.A.	Boeing 707	Feb. 4	St. Louis	None	All	Ran off end of runway. Damaged.
Lloyd Aereo Boliviano	DC-4 (CP-609)	Feb. 5	Cochabamba	55P, 4C	None	Engine fire in flight?
†Aerolineas Argentinas	Comet 4 (LV-AHO)	Feb. 20	Buenos Aires	None	9	Landing accident on training flight; followed by fire. Destroyed.
Alaska Airlines	DC-6A (N11817)	Feb. 22	Elmendorf, Alaska	None	All	Landing accident. Aircraft destroyed.
REAL-Aerovias	DC-3 (PP-AXD)	Feb. 25	Rio de Janeiro	28	None	Collision with U.S.N. DC-6 (35 killed).
Alitalia	DC-7C (I-DUVO)	Feb. 26	Shannon	34	18	Immediately after take-off.
B.O.A.C.	Comet 4 (G-APDS)	Mar. 14	Madrid	None	All	Struck high ground on approach. Successful landing at airport followed.
*A.I.D.A.	PBY-5A (HK-1001)	Mar. 15	East Columbia	4P, 2C	Some	Landing accident.
All Nippon Airways	DC-3 (JA-5018)	Mar. 16	Nagoya	2P, 1C	30	Collision on runway during landing with Air Force F-86.
Northwest	Electra (N121U)	Mar. 17	Tell City, Ind.	57P, 6C	None	Structural failure in the air.
S.A. Medellin (S.A.M.)	C-46 (HK-516)	Mar. 19	Nr. Medellin	26P, 3C	17	Engine failure (?) on approach in poor visibility.
†C.A. Faucett	DC-3 (OB-PAM)	Mar. 21	Peru	4C	None	Flew into mountain. On freight service.
Lineas Aereas de Nicaragua	C-46 (AN-AIN)	Apr. 5	La Luz Mine Airport	3P, 1C	Some	Engine failure after take-off.
Varig	DC-3 (PP-CDS)	Apr. 12	Pelotas, Brazil	5P, 2C	15	Tyre burst on take-off; hit parked aircraft and burned.
Lloyd Aereo Colombiano	C-46	Apr. 19	Bogota	28P, 3C	19	Landed short of runway.
Piedmont	F-27 (N2704R)	Apr. 20	Hickory, N.C.	None	39	Collision on approach with Cessna 310 (four occupants killed).
*Sobelair	DC-4 (OO-SBL)	Apr. 22	Nr. Bunia, Congo	28P, 7C	None	Hit mountain while descending to land.
L.A.V.	DC-3 (YV-C-AFE)	Apr. 28	Nr. Calabozo, Venezuela	11	3	Sabotage; grenade exploded on board.
†Navegacao Aerea Brasileira	C-46 (PP-MMD)	May 3	Puerto Rico	5C	None	Hit hill while attempting to land after engine failure.
T.W.A.	Boeing 707 (N765T)	May 9	Idlewild, N.Y.	None	All	Attempted overshoot; aircraft settled on runway with undercarriage up.
*Balair	DC-4	May 16	Toli, Sudan	2P, 10C	None	Hit Mount Jebel Marra on positioning flight.
*Transamerican Air Transport	C-46 (LV-GGJ)	May 18	Andes, Chile	10	None	In poor weather over central Andes range.
Air Algerie	Caravelle (F-OBNI)	May 19	Paris	1P	36	Collision with SV4 (pilot killed) while approaching Orly. Successful landing followed.
†Delta Airlines	Convair 880 (N8804E)	May 23	Atlanta	4C	None	Take-off on training flight (simulated power loss?).
T.A.A.	F-27 (VH-TFB)	Jne. 10	Mackay, Qd.	25P, 4C	None	Crashed in sea while attempting to land in bad visibility. Altimeter misread?
Pacific Northern	L-749 (N1554V)	Jne. 14	Mt. Gannet, Alaska	9P, 5C	None	Hit mountain when off course.
REAL-Aerovias	Convair 340 (PP-YRB)	Jne. 24	Guanabara Bay	46P, 5C	None	Crashed in bay in bad visibility while waiting to land at Rio.
Lineas Aereas Costarricenses	DC-3 (TI-1023)	Jne. 25	Nr. San Jose	1P	13	Crashed soon after take-off.
*Kalinga Air Lines	DC-3 (VT-DGS)	Jly. 10	Nr. Sharjah	13P, 3C	None	Believed lost in sandstorm.
*U.N. Mission to Colombia	DC-3	Jly. 11	Nr. Quito	18	None	Flew into Pichincha mountain.
Northwest	DC-7C (N292)	Jly. 14	Nr. Luzon	1P	57	Ditched with engine fire.
Philippine Air Lines	DC-3 (PI-C-16)	Jly. 14	Nr. Mindanao	None	31	Ditched short of fuel after bad-weather diversion.
*Zone-Redningskorpset	DH89A (OY-DZY)	Jly. 16	Kastrup	8P	1	Pilot error in bad weather after take-off.
Ethiopian Air Lines	Convair 340 (ET-T-18)	Jly. 16	Ethiopia	1C	10	No information.
Trans-Texas Airways	DC-3 (N10608)	Jly. 22	Houston, Texas	1C	10	Collided on ground with stationary DC-7 after brake failure.
Chicago Hellicopter Airways	S-58C (N879)	Jly. 27	Chicago	11P, 2C	None	Structural failure?
*Deutsche Flugdienst	Convair 240 (D-BELU)	Jly. 31	Rimini, Italy	1P	33	Crashed while making single-engined approach.

* Charter or un-scheduled operation. † Training flight or special operation by scheduled airline. P, passengers. C, crew.

AIRLINE	AIRCRAFT	DATE	PLACE	CASUALTIES		REMARKS
				Killed	Survived (including injured)	
Pacific Western	Beaver (CF-ICK)	Aug. 15	Lorna Lake, B.C.	3P, 1C	None	Take-off in gusty conditions.
Aeroflot	Ilyushin IL-18	Aug. 17	Nr. Kiev	27P, 8C	None	Fire in wing after engine combustion chamber collapsed.
*Don Everall	Viking (G-AMNK)	Aug. 24	Off Iraklion, Crete	3C	None	Crashed in sea after take-off.
Qantas	L-1049C (VH-EAC)	Aug. 24	Mauritius	None	45	Engine failed on take-off; hit obstruction and burnt. Totally destroyed.
Air France	L-1049G (F-BHBC)	Aug. 29	Off Dakar	55P, 8C	None	Flew into sea while attempting to land in bad weather.
*United Arab	DC-4 (YK-AAR)	Aug. 30	Bolobo, Congo	None	14	Short of fuel, flying U.N. supplies.
*Trek Airways	DC-4 (ZS-CIG)	Sept. 3	Nr. Assiout, Egypt	None	71	Force-landed in desert with uncontrollable engine fire. Total loss.
Aerolineas Argentinas	DC-6 (LV-ADS)	Sept. 7	Nr. Salto, Uruguay	25P, 6C	None	Broke up in storm. Lightning?
American Airlines	Electra (N6127A)	Sept. 14	La Guardia, N.Y.	None	75	Low on the approach, hit dyke, overturned and burnt. Total loss.
Braniff	DC-7 (N5900)	Sept. 14	Dallas	1C	6	Brake failure while taxiing; hit hangar.
*World Airways	DC-6B (N90779)	Sept. 18	Guam	75P, 5C	14	M.A.T.S. charter. Crashed after take-off.
Austrian Airlines	Viscount (OE-LAF)	Sept. 26	Nr. Moscow	25P, 5C	6	Hit trees on approach. Altimeter misread?
Mexicana	DC-3 (XA-HUS)	Sept. 28	Nr. Mexico City	5	13	Flew into mountain in fog.
United Arab	Viscount (SU-AKW)	Sept. 29	Nr. Elba	17P, 6C	None	Disappeared at sea.
Eastern Air Lines	Martin 404 (N466A)	Oct. 1	Orlando, Fa.	None	26	Collision with Bonanza (pilot killed) on approach.
Eastern Air Lines	Electra (N5533)	Oct. 4	Boston Harbour	59P, 3C	11	Power loss (?) on take-off. Bird ingestion (?).
*Capitol Airways	C-46 (N4719N)	Oct. 4	Sacramento	None	2	Collision with Cessna 172 (two killed) on approach.
Air France	Boeing 707 (F-BHSJ)	Oct. 7	Guadeloupe	None	All	Landed short in poor visibility; badly damaged.
Itavia	Heron (I-AOMU)	Oct. 14	Elba	7P, 4C	None	Flew into Mt. Capanne.
*Capitol Airways	C-46 (N1300N)	Oct. 15	Nr. Ogden, Utah	2C	None	On charter to U.S.A.F.
American Airlines	Boeing 707 (N7508A)	Oct. 25	Fort Worth	None	126	Emergency landing with nosewheel up.
Northwest	DC-4 (N48762)	Oct. 28	Missoula, Mont.	8P, 4C	None	Hit mountain while descending.
*Arctic-Pacific Inc.	C-46 (N1244N)	Oct. 29	Toledo, Ohio	20P, 2C	26	Overweight take-off in bad weather.
S.A.A.	Boeing 707 (ZS-CKC)	Oct. 30	Nairobi	None	91	Hit ground 1½ miles from airport during approach. Successful wheels-up landing followed.
†Royal Nepal Airlines	DC-3	Nov. 5	Bairihawa, Nepal	4C	None	Crashed and burnt during take-off.
Aerovias Ecuatorianas	F-27 (HC-ADV)	Nov. 7	Nr. Quito	34P, 3C	None	Flew into mountain in bad weather.
Iberia	L-1049G (N7125C)	Nov. 8	Barcelona	None	71	Landed short of runway. U/c. collapse, followed by fire. Total loss.
B.O.A.C.	Britannia (G-ANBC)	Nov. 11	Khartoum	None	27	Belly landing after hydraulic failure. Serious damage.
United Air Lines	DC-6 (N37523)	Nov. 17	Stapleton, Denver	None	17	Collision on approach with Bonanza. (No casualties.)
Philippine Air Lines	DC-3 (PI-C-133)	Nov. 23	Mindoro Island	29P, 4C	None	Flew into Mt. Baco.
REAL Aerovias	C-46	Dec. 7	Nr. Cachimbo	15	None	No information.
†Airlines of N.S.W.	DC-3 (VH-INI)	Dec. 12	Nr. Sydney	3C	None	Crashed into sea on training flight.
T.W.A.	L-1049 (N6907C)	Dec. 16	Over New York	39P, 5C	None	Collision while on descent to La Guardia and Idlewild respectively. Six persons killed on ground.
United Air Lines	DC-8 (N8013U)	Dec. 16	Over New York	77P, 7C	None	
Philippine Air Lines	DC-3 (PI-C-126)	Dec. 22	Cebu City	26P, 2C	9	Hit trees immediately after take-off. Engine failure?
B.O.A.C.	Boeing 707 (G-APFN)	Dec. 24	London Airport	None	106	Ran off runway on landing. Badly damaged.

* Charter or non-scheduled operation. † Training flight or special operation by scheduled airline. P, passengers. C, crew.

accidents, causing 85 passenger fatalities at an estimated rate of 2.3 per 100 million revenue passenger-miles.

No very obvious reason for the adverse trend in safety in 1960 appears from the tabulation. Of the 82 accidents and incidents recorded, 13 were to turbojet aircraft, 12 to turboprop types and the remainder to piston-engined transports (including one helicopter). The turbojets, however, suffered only three accidents involving passenger fatalities and two of these were mid-air collisions in which the type of aircraft was (presumably) irrelevant. Thus the 1960 safety record was satisfactory at least in so far as it did not confirm the worst fears of many observers that the wide-scale introduction of big turbojets would be attended by some major catastrophies.

A breakdown of the accidents listed in our tables into approximate categories is as follows:

Take-off	14
En-route	
Structural or mechanical	7
Sabotage	2
Flew into ground	12
Others	7
Collision on descent or approach	8
Approach and landing	25
Unclassified	3
Ground incidents, taxiing	3

This breakdown shows clearly that the approach and landing phases of a flight are still potentially the most dangerous, although the total of 25 includes a number of non-fatal incidents. Especially was this the case with turbojet aircraft; of the 13 such aircraft tabulated, nine were involved in non-fatal landing incidents which destroyed or seriously damaged the aircraft. Such a comparatively high proportion of landing incidents among turbojet transports (six of the nine were Boeing 707s) stresses the fact that the handling, on the approach, of these large, heavily loaded and unforgiving aircraft requires the closest attention. The fact that more passengers were not killed in these incidents is a tribute to sound structural design, good airmanship—and good fortune.

The take-off phase accounted for the next highest number of incidents, the majority in this category being piston-engined aircraft which probably suffered power failure. One of the most disturbing statistics is the number of accidents—all, inevitably, fatal—in which aircraft flew into high ground through being off course or through altimeter misreading.

Another significant group of accidents was in the category of collisions. Four of the eight involved passenger fatalities, including two killed in an All Nippon DC-3 which was hit on the ground by a Japanese Air Force jet fighter, and one killed in the Air Algérie Caravelle which, mercifully, was able to continue its approach to Orly after being struck by a light aircraft. Five of the eight collisions occurred in the U.S.A., and in each of these cases the airliner was on its approach to the airport. One of these accidents was, of course, the DC-8/L-1049 collision over New York; the others were all between airliners and lightplanes, in which the airliners were able to land without mishap, but the lightplanes (with one exception) crashed, causing the death of their occupants. The frequency of airliner/lightplane collision in approach patterns in the U.S.A. can be attributed to the mixing of IFR and VFR flights and the large number of light aircraft movements.

The extent to which human error can be blamed for 1960's accidents is almost impossible to tell at this stage, but it can be said that this cause can at present be specifically excluded from comparatively few. As one would expect, better engineering practice and growing experience, together with turbine engine reliability, has led to a reduction in disastrous structural and mechanical failures in flight, although engine fires in certain types of piston engine continue to be a hazard. Misread altimeters were blamed, at least indirectly, for three accidents during the year—the S.A.S. Caravelle, Austrian Viscount and T.A.A. Friendship—and could explain others.

It would be wrong to assert that the 1960 accident record as a whole is relevant to the kerosene v. JP.4 controversy, but it can be said that a number of passengers probably survived because JP.4 was not being used (e.g. in the American Airlines Electra and perhaps the B.O.A.C. 707) whilst others (e.g. especially in the Avianca L-1049 which caught fire in a heavy landing) would probably have survived in a turbine transport using kerosene. The year's total included the first major accident to a passenger-carrying helicopter, and the first involving the Caravelle, DC-8, F-27 and, so far as is known, Il-18.—F.G.S.

Air Transport . . . .

Air Traffic in 1960

ICAO figures for the air transport effort of its 83 member states in 1960 show a healthy increase of 14% in passenger-miles and cargo ton-miles, with more than 100 million passengers carried in a year for the first time. Increases of this order or greater have been shown in the passenger-miles flown in every post-War year except 1958, when the business recession held it back to 5%, and in 1948, when an 11% increase was recorded.

The greater part of the increased business is attributable to the larger number of passengers flying—a 10% increase over 1959. These were accommodated in larger, faster aircraft, as shown by the fact that the total hours flown remained unchanged at 8.9 million, and the total miles flown increased by only 4%. The average number of passengers per aircraft increased from 32 to 35 and the average distance flown per passenger was up by 4% to 640 miles. The average speed of air transport throughout the World is, however, still remarkably low at 221 m.p.h., compared with 177 m.p.h. 10 years ago.

The ICAO statistics are summarized below:—

	1960	1959	Increase
Miles	1,975m.	1,910m.	4%
Hours flown	8.9m.	8.9m.	0%
Passengers carried	108m.	98m.	10%
Passenger-miles	69,000m.	60,000m.	14%
Cargo ton-miles	1,495m.	1,315m.	14%
Mail ton-miles	410m.	355m.	15%
Passengers per aircraft	35	32	9%
Miles per passenger	640	618	4%
Miles per hour	221	214	3%

Feuding at Fiumicino

ALTHOUGH various official announcements of the opening of Rome's new Leonardo da Vinci Airport at Fiumicino have been made in recent months, the airport has not, in fact, yet come into use. This has been because the 22 Rome airlines, through the Airline Operators' Committee, have not so far been satisfied that Fiumicino was ready for full-scale operations, and have been busy in consultation with the Directorate General of Civil Aviation, persuading the authorities to remedy "certain obvious shortcomings in the facilities available."

On Dec. 28, however, the situation changed suddenly when Alitalia, although a member of the A.O.C., unilaterally and without any consultation with the Committee, published a statement to the effect that all its services, both domestic and international, would be transferred from Ciampino to Fiumicino at one minute after midnight on Jan. 16, 1961.

This independent action by Alitalia, apart from being entirely contrary to the spirit and policy of the A.O.C., has resulted in considerable dismay and confusion among all the other airline operators. Its effect is to hold a pistol to the head of many operators who, if Alitalia moves from Ciampino, will find it extremely difficult to continue to operate efficiently, since many of the handling facilities and personnel for airlines using Ciampino-West, including P.A.A., T.W.A., S.A.S. and Sabena, will automatically go to Fiumicino with Alitalia. In spite of this, the Airline Operators' Committee is determined only to agree to a transfer to Fiumicino if and when it is fully satisfied that the facilities offered are acceptable and that, above all, the degree of flying safety is in no way diminished.

The Airline Operators' Committee reacted rapidly to Alitalia's move. Within 24 hours of Alitalia's announcement, the A.O.C. had appointed four expert sub-committees, which started work immediately, to inquire into and report on four different aspects of Fiumicino's readiness. These are—flying safety and air traffic control, communication facilities, refuelling facilities and passenger handling. Upon the report of these sub-committees will depend the final decision of the A.O.C., which is binding on all its members.

The airlines are in fact anxious and impatient to complete the transfer to Fiumicino and will accept various inconveniences on behalf of their own staffs quite cheerfully. But in anything which concerns flying safety they will make no compromise whatsoever. Thus the particularly important points which await the findings of the expert sub-committees are, for instance, the adequacy and readiness of the communications system installed at the new airport, with special emphasis on channels of communication with the Rome A.C.C., which remains at Ciampino and will continue to control the arrival and departure of all aircraft at Fiumicino; the efficiency of the air traffic control organization and equipment at the new airport, which will be operating from a temporary control tower; the limitations of the Rome A.C.C. surveillance radar which remains located near Ciampino and which must do duty for Fiumicino until, eventually, a new radar is installed there. Another important factor, which may well affect turn-round times and the actual operational capacity of the new airport, is that the satellite bulk storage installations are unlikely to be complete and that, consequently, a mixture of hydrant refuelling and tanker refuelling may be necessary.—T.D.C.

Establishing a First

SUPPORTED by an advertising campaign announcing the "World's first turbine-powered helicopter scheduled passenger service" the Sikorsky S-62 was put into service by Los Angeles Airways on Dec. 21 on its routes from Los Angeles International Airport to heliports at Riverside, San Bernardino and Anaheim/Disneyland/Fullerton. The "first" claimed by Los Angeles Airways in this respect appears to be open to dispute, as two other U.S. operators have been using turbine helicopters—Sud-Aviation Alouette IIs—for several months.

These other two operators—Air Florida Helicopter Airways and Sea-Tac Airways—both operate on an air taxi certificate, which allows them to engage in air transportation with aircraft of up to 12,500 lb. gross weight without restriction on frequency or regularity of service. Los Angeles Airways—in common with New York Airways and Chicago Helicopter Airways—on the other hand, operates on a certificate of public convenience and necessity which is subject to the same C.A.B. restrictions as apply to fixed-wing operators. This certification difference is no doubt the basis of the L.A.A. claim—but timetables for scheduled passenger services by both Air Florida and Sea-Tac, in the Tampa and Seattle areas respectively, appear in the monthly *ABC World Airways Guide*.

The L.A.A. S-62 is on lease from Sikorsky to allow the company to gain experience of turbine operations, pending delivery later this year and in 1962 of the fleet of five Sikorsky S-61Ls, the first of which flew on Dec. 6 last.

S.A.S. VISCOUNT.—With its stylized Viking-ship livery, this Viscount 779 is one of two leased by S.A.S. from Fred Olsen to operate domestic Norwegian services out of Oslo, where noise restrictions prevent jet operations.

David Owen buys a four-seater

(with a little advice from Dad)

What's the use of a pilot father if he hasn't a plane to pilot? True, Dad's old plane was a Lancaster, a shade bigger than this . . . but David's quite prepared to settle for this neat tourer.

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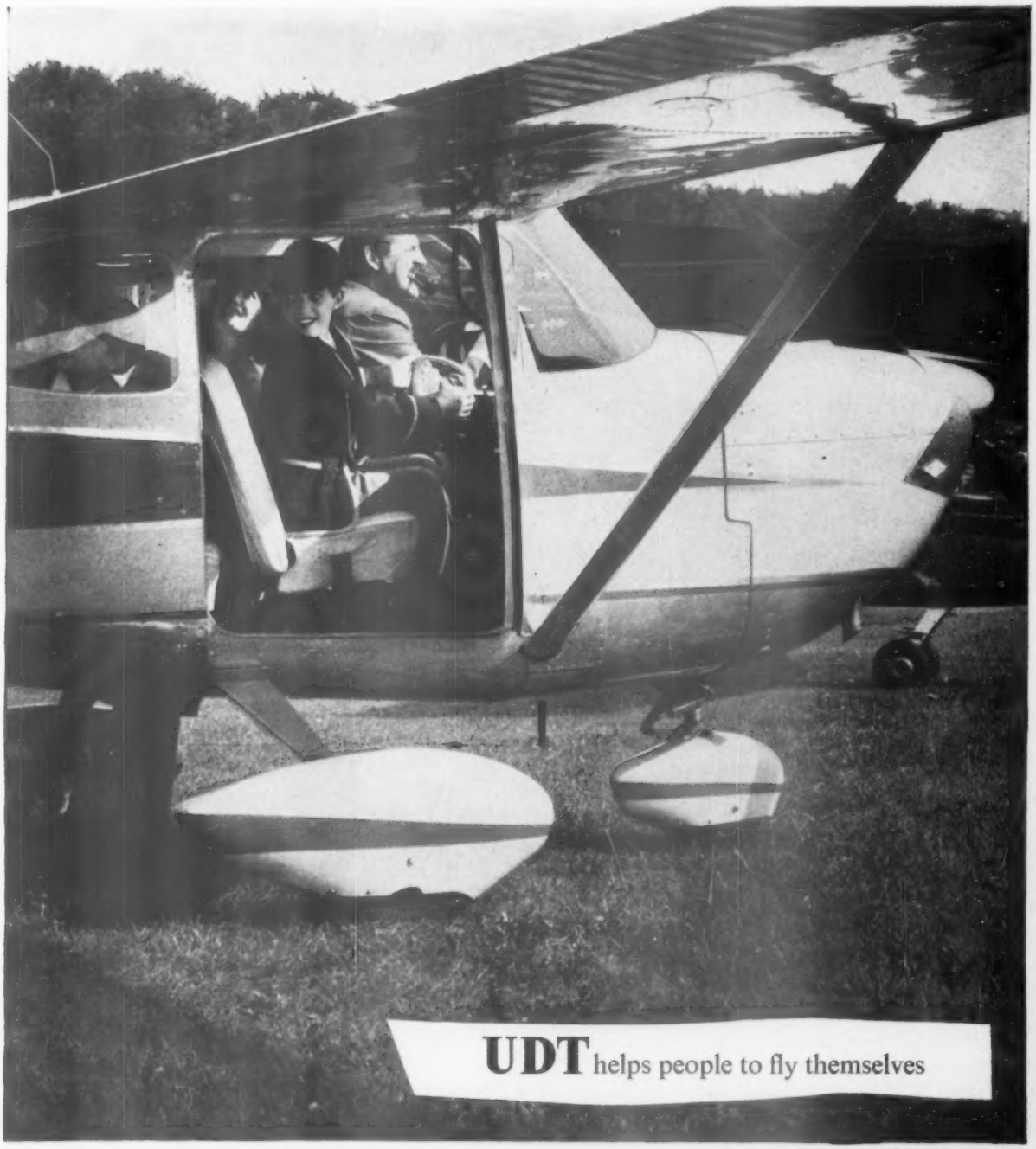

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Book Reviews

A Pride of Unicorns

I MUST say that John Pudney has chosen a provocative title for his biography of the famous Atcherley twins.* Not having read Priestley's essay, I did not know that he had called the gentlemen of the Establishment "Lions," and the poets and men of genius "Unicorns."

Probably I would buy the book just to see what it was all about even if the front cover did not mention the Atcherley name. I have always wanted to see "The Amorous Prawn" because of the intriguing title. But surely he should not have made the collective noun a "pride," for that is the collective noun for lions. Very rightly so if you think of many worthy but dull members of the Establishment. Really the collective noun for unicorns is a "thrust"; for unicorns and Atcherleys thrust aside opposition and red tape to get their own way.

The author has traced the career of the Atcherleys from the time of their boyhood in their happy Yorkshire home up to the present day, where Sir Richard, the last and greatest of the Atcherleys, lives in his caravan at Hamble directing the sales affairs of Folland Aircraft, Ltd. It is indeed a fascinating record which will appeal not only to the thousands in England and in America who knew, or who know of, the Atcherleys but also to all students of the characters of great men of genius.

The Royal Air Force, thank God, has never moulded its officers into a set type. Which, of course, is why the youngest service has produced far more unicorns than the Army or Navy. Men like Trenchard, Embry, Bandon and the Atcherleys never could conform to a set pattern. Often regarded as mad they stand out like shining beacons in a mediocre world. Yet all shared in common a fanatical love of their Service to which they devoted their lives.

This book is largely based on the letters sent from the twins to their beloved mother, their dear "Pompkins." As the author explains, it is inevitable that the emphasis of the book is more on Dick than on David, not only because the records of Dick are more complete but also because Dick is the only survivor and therefore could help the author in preparing the biography. I bet poor John Pudney had a time when the book was being written. But in my opinion, and I first got to know the lovable twins many years ago, that emphasis is correct because Dick's genius outshone that of his almost equally famous twin.

There is little to criticize in this joyous account, although even Dick's eagle eye missed one or two errors like the spelling of Joe Fogarty and Reggie Lydford's names (oh, Dick!). There is an absolute wealth of what I call Atchernalian stories. Sometimes the reader gets a little confused as to whether the author is writing about Dick or David, but, since the twins were so absolutely identical in appearance and in their mannerisms, such confusion is excusable.

It is probably inevitable that, when writing the chronicles of two such light-hearted people, the fun and games, the practical jokes and quaint expressions, are inclined to overshadow their really great achievements. For instance, I wish the author had spent more time in describing the development of the Drem lighting system. This was not only Dick Atcherley's idea, but the idea was backed up by a mass of careful experimental work and brilliant improvization in obtaining material in spite of officialdom. From that great work of genius has come the aerodrome lighting systems of the whole World. Had Dick been a business man he would have become a multi-millionaire from that invention alone.

Then there was his brilliant work, again without official support, on flight refuelling. I know full well how much time and effort he put in to prove his ideas by practical experiment. Then an ungrateful Air Ministry handed his patents over to Sir Alan Cobham on a plate.

Again the report written by a brother officer "with a mischievous pen" after a visit with Dick Atcherley to Germany in 1937 (or was it not 1936?) had a far-reaching effect on the air policy of this country, and that report would not have been written had it not been for Dick Atcherley. That little episode would make a story itself. Perhaps it will one day.

John Pudney has given a faithful account of the great work done by the twins during the War, but perhaps it is a pity that the great achievements of the Atcherleys, and especially of Dick Atcherley, in peace time are rather overshadowed by the many accounts of what one might call the playboy side of the Atcherley character.

I wish this book could be read by every member of the Establishment and indeed by everyone in positions of power and influence. It shows that one can achieve great things and great results without developing into a pompous stuffed shirt. It is possible to work hard for a great ideal and for a great and serious purpose, yet preserve a sense of fun and enjoy life to the full.

The Atcherleys have shown us how to do it.—H. V. ROWLEY.

* "A Pride of Unicorns" (Biography of the Atcherley Brothers). By John Pudney. 241 pp.; 5½ in. x 8¾ in. Illustrated. Oldbourne Press. Price 21s.

Two Views of the D.H. Story

I MOST people seem to think that Britain's backwardness in the development of airliners compared with the United States stems from the days of the Hitler War when Britain was fighting for survival and had to concentrate on building only fighters and bombers, while the U.S.A. went on building airliners and troop-carriers. But the root of evil goes back much further, as is seen from Martin Sharp's biography of Sir Geoffrey de Havilland entitled, with splendid simplicity, just "DH."*

Mr. Sharp quotes letters written by D.H. to the Air Ministry (then responsible for civil aviation as well as military) in November, 1934, and March, 1935, urging the Ministry to give financial aid for the development of British airliners. "We believe that failure to take account of American progress, and to act promptly and effectively to recover our backwardness, will have far-reaching consequences." It did indeed! For the Air Ministry hardened its heart and sinned yet more, not comprehending the urgency of this S.O.S. nor the gravity of the situation, for they did exactly nothing—which is why 707s, DC-8s and other American airliners sell in hundreds today; while British airliners (save the Viscount) sell in driblets. If only people in the Ministry of Aviation would read, mark, learn and inwardly digest this book and profit by the mistakes and apathy of their predecessors, Martin Sharp will not have lived in vain!

This most readable book traces the story of the 25-year-old Geoffrey de Havilland from 1908 when he met Frank Hearle, four years his junior, while both were working on the new-fangled motorbuses. D.H.'s imagination was fired by the Wrights and he persuaded his grandfather to give him £1,000 to build an aeroplane when none had flown in Britain. That his grandfather gave him the money to found a new industry where none existed, and to agree to the young man giving up a good job to follow his star, shows that D.H.'s vision must have been hereditary. For two years later the first de Havilland aeroplane flew—and that is how we have Comets today.

The book begins with an absorbing romantic narrative in which the author depicts D.H. in good times and in bad and describes his struggles to overcome difficulties. His first biplane broke when the load came on the wings and it dropped from about 15 ft. Luckily D.H. escaped with a shaking. When asked what was wrong he replied characteristically, "There was hardly anything right with it!" but insisted that he and Hearle were right to build something to their own vague ideas and then learn from their mistakes.

Their second aeroplane flew well and was bought by the R.A.F.—the Royal Aircraft Factory at Farnborough, not the Royal Air Force then—and D.H. was engaged as pilot designer to the "Factory" and Hearle was engaged as his mechanic.

It was there that they first met George Holt Thomas and Frank Halford, who were to play such important parts in the D.H. story. Holt Thomas had formed the Aircraft Company, Ltd. (also known as Airco), to build Farmans under licence in England. And in 1914 he thought it wise not to be so dependent on French designs, so he engaged D.H. at a salary of £600 a year plus commission on sales.

"We shall have to pull our socks up, as I'm paying Mr. de Havilland a large salary to come here," Holt Thomas told his works superintendent.

Within three months came the Kaiser War and the famous D.H. series began. Throughout the four years of war D.H. shouldered the enormous responsibility of helping to keep British pilots flying aircraft superior to those of the enemy. He was constantly bedevilled by the change of official mind

* DH—An Outline of de Havilland History. By C. Martin Sharp. 420 pp.; 5½ in. by 8½ in. Faber and Faber. Price 42s.

and policy, and the shortage of engines. This latter explains what has always been a mystery to me—why the D.H.9 had such an inferior performance to the D.H.4 which it was intended to supersede.

When the armistice came in 1918 and the stress was reduced, D.H. collapsed with exhaustion and strain for he had been living on his nerves; and when the tension relaxed he was like a spring that had too long been tightly coiled and snaps from metal fatigue. So D.H. was ordered by his doctor to go away for a rest but he came back to work as soon as he could and began planning airliners for what all believed would soon be a vast civil air line business now peace had come—alas, they little knew it would be years and years before civil aviation was financially worthwhile.

The famous team which began with D.H. and Hearle was augmented in Airco days by C. C. Walker, Fra. St. Barbe and W. E. Nixon and they were the nucleus around which the de Havilland Aircraft Co. was formed in September, 1921, the very month the Hawker Aircraft emerged from the defunct Sopwith Co., leading to the Hawker Siddeley Group, now D.H.'s parent firm.

Though I remember the early years of the de Havilland company very well indeed, I little knew on what a slender financial shoe-string it hung. The story is vividly told of how a young man from Bristol, Alan Butler, became interested in aviation and wanted a specially designed aeroplane. I first met him when he landed at Croydon Airport in his Bristol Tourer and he told me he wanted something more modern. So I advised him to get in touch with D.H. and the following day he came to see me at THE AEROPLANE office in Piccadilly and I introduced him to C. G. Grey who phoned D.H. to make an appointment for Butler to see D.H. Butler was eventually chairman of the de Havilland Company.

Some months after Butler first met D.H. the question of an investment arose at a crucial moment when D.H. wanted to buy Stag Lane (where they first settled) outright. Butler suggested investing £50,000, but D.H. told him they didn't need as much as that. Later D.H. told his friends that saying that might give Butler the idea that "we were not complete crooks"!

The author then tells of the famous early D.H. airliners, the D.H.4a, 16, 18 and 34, which helped to keep British airliners flying in the formative years of civil aviation. And the story of the D.H. air taxi service is as entertaining to read of as it was to watch its early struggles. But what brought fame and fortune to the firm was the Moth. How often in the late 1920s did St. Barbe tell me, "The Moth is our bread and butter!" And, of course, we are told the story of how the Cirrus engine was designed for the Moth by Frank Halford and made of half an Airdisco engine and how it led to the series of D.H. Gipsies which are still very much with us.

C. Martin Sharp.

The air taxi service, the little 1923 D.H.53, which can be seen at Hatfield yet, and the Moth, introduce Alan Cobham, who won his K.B.E. for a series of world flights in D.H. aircraft; and we hear of Hubert Broad, Charles Barnard and others who hit the headlines in the 1920s.

And then comes the Comet racer, the D.H.88 which, if the Air Ministry had had the gumption to give D.H. the financial aid they needed, might have been a four-engined metal airliner of vast impact in 1934 which could have given us a lead over the Americans we might have kept—instead of merely a two-seat racer.

This is a vastly important and readable history as one would expect from an author who learned his craft on THE AEROPLANE under the great C. G. Grey. The research involved simply staggers me so I can excuse a few misspelt proper names which do not affect nor mar the story and will no doubt be put right in subsequent editions.

It is copiously illustrated and the end-pages fore and aft are adorned with line drawings in strips depicting the D.H. story from the motor-bike designed and built by D.H. when he was a student at the Crystal Palace (seen in the background) School of Engineering and most of his aeroplanes from the beginning to the Comet 4.

Though my task was only to review Book One I could hardly put it down till I'd read the lot.—G.D.

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2 THE story of the development of de Havilland transport aircraft forms an integral and most important part of Mr. Sharp's history. After describing the first post-1914-18 War transports, which were evolved from wartime single-engined bombers, Mr. Sharp shows how de Havillands did good business between 1919 and the early 1930s with a series of small single-engined types following the same theme—the D.H.16, 18, 34, 50, 61 and 83. He refers briefly to the interesting D.H.29 10-passenger transport, with its tapered cantilever wooden monoplane wing, which first flew in July, 1921, and which, if its unsatisfactory flying characteristics could have been resolved, might have enabled D.H. to establish a design family which could have rivalled the success of the Fokker and Junkers monoplanes on the Continent.

As it was, the monoplane was dropped and de Havillands stuck with the simple "stick-and-string" biplane formula which proved, for many years, to be appropriate to small, inexpensive, feeder aircraft but which, by the early 1930s, had become outclassed for the larger types of transport. De Havillands did produce one larger airliner before this stage was reached. Eleven D.H.66 Hercules three-engined 12-seaters were built for Imperials and West Australian Airways in 1926-27. These did good work for a number of years, opening up some of the Empire air routes.

De Havilland's next major transport resulted directly from the MacRobertson Race from England to Australia in October, 1934. The race demonstrated to the whole World the promise of the new American metal monoplanes. As a result, within three weeks, the D.H. company proposed to the Air Ministry that they should themselves develop a competitive monoplane airliner. Unfortunately, the firm's experience with wooden structures persuaded them against the stressed-skin all-metal form of construction which was the most important feature of the American designs.

The author seeks to defend this policy on grounds that there was insufficient potential market in this country to justify tooling for construction in metal. This argument is not convincing, particularly when one also reads that no less than 62 D.H.86 12-passenger biplanes were sold from 1934. No disinterested student of British aircraft development is likely to reach any other conclusion but that, if D.H. had in 1934-35 produced a metal monoplane equivalent to the American 14-passenger DC-2 of 1933-34, they would have sold considerably more than 62 of them. Yet both Douglas and Boeing, despite their much higher labour costs, broke even with their all-metal designs after building between 50 and 75 of each type.

The wooden D.H.91 Albatross, which eventually resulted from D.H.'s 1934 proposals—it did not fly until May, 1937—was of comparable capacity, although of rather higher speed and longer range than the American DC-3 which had first flown late in 1935. If de Havillands had energetically undertaken the development of a British equivalent to the DC-3 in 1934, it seems likely in retrospect that such an aeroplane could have shared the American type's success and could have earned de Havillands a great deal of money. It would also have done much to prevent the grave decline in Britain's position as a leading air transport nation, which started in the early 1930s and from which we are still suffering today.

The first two British firms to go over to the new form of construction (Bristol and Supermarine) flew their first all-metal stressed-skin monoplanes in 1934, but neither of these companies had de Havilland's background in the civil field. Most of the major firms in the industry did not take this vital step for another two to four years and de Havillands did not fly their first machine of this type until the end of 1938. This was the D.H.95 Flamingo, a DC-2-size high-wing transport. Sixteen had been built by the time war came but, being by then more than five years behind the Americans, it had pretty well "missed the boat" so far as export sales were concerned.

Although this country lost its chance in the field of major transport aircraft development in the years just before the War, de Havillands did good work in producing small feeder-type aircraft. This book records the success of the little twin-engine Dragon and Rapide biplanes, which proved to be outstanding in their class.

After the War, de Havillands have continued to do well in the same category with their metal stressed-skin monoplane Dove and Heron. Mr. Sharp also recounts the tragic Comet story and succeeds better than most previous writers in putting the sequence of events into coherent perspective. He shows very clearly how de Havillands, with their jet transport, succeeded initially in establishing a lead over the rest of the World comparable to that of the American manufacturers with their metal monoplanes in the 1930s. Future historians may regard as significant the fact that it was a structural deficiency which led to this opportunity being largely thrown away. They may also wonder why the Ambassador was not pushed through to full success after it had made such a promising start.—PETER W. BROOKS.

The Fighting Services

R.A.F. Promotions

IN the half-yearly list which took effect on Jan. 1, the Air Ministry announce 26 air rank promotions.

Air Vice-Marshals A. D. Selway, Sir Wallace Kyle and R. B. Lees have been promoted to the rank of Air Marshal. Air Commodores G. C. Eveleigh, W. E. Coles, J. R. Gordon-Finlayson, E. L. Colbeck-Welch, M. E. M. Perkins and E. Knowles have all been promoted to the rank of Air Vice-Marshal.

Group Captains A. V. R. Johnstone, H. P. Connolly, J. M. N. Pike, B. R. Macnamara, H. N. G. Wheeler, J. H. Lapsley, L. MacD. Hodges, D. C. Stapleton, J. A. Robinson, B. H. Boon, W. F. Beckwith, J. C. Pope, S. G. Walker, C. G. Stowell, C. C. Barker, G. R. Gunn and A. A. McGregor have been promoted to the rank of Air Commodore.

Queen's Colour for F.E.A.F.

IN a floodlit parade at R.A.F. Changi today, the Earl of Selkirk, United Kingdom Commissioner for Singapore and Commissioner-General for South-East Asia, was to present a Queen's Colour to the Far East Air Force.

For the ceremony, flights of 50 officers and men will be drawn from the three Service bases on the Island—Changi, Tengah and Seletar—from the R.A.A.F. base at Butterworth, from units of the R.N.Z.A.F. at Changi and Tengah, and from No. 94 Squadron of the R.A.F. Regiment, Malaya. Three bands, the Central Band of the R.A.F., flown from the United Kingdom to Singapore for the occasion, the F.E.A.F. Band, and the Seletar Pipe Band, will be directed by Wg. Cdr. J. L. Wallace, Organising Director of Music. The Air Council will be represented by the Air Member for Personnel, Air Marshal Sir Arthur McDonald.

The Colour Escort Squadron will comprise three flights from Nos. 41 and 75 Squadrons, R.N.Z.A.F., No. 15 (Field) Squadron, R.A.F. Regiment, and from the R.A.A.F. at Butterworth. Parade commander will be Wg. Cdr. C. H. Baker, and the Escort Squadron commander Sqn. Ldr., P. Lovatt, R.A.F. Regiment.

Originated 31 years ago with a visit to Singapore by four Supermarine Southamptons, F.E.A.F. is the third of the Services' air forces to receive a Queen's Colour. Both the R.A.F. in the United Kingdom and the Middle East Air Force have been awarded Colours.

Higher Technical College Status

A SIGNIFICANT step in the growth and development of the R.A.F. Technical College, Henlow, is the recent decision by the National Council for Technological Awards, to recognize all technical cadets taking the College course as eligible for the Diploma of Technology—the equivalent of a university honours degree. The R.A.F. thus becomes the first Service to provide a Dip. Tech. course.

First cadets to benefit under the Council's resolution will be those of the intake of last autumn, who, as in the case of subsequent intakes, will now train at Henlow for four years and two terms before taking their end-of-course examinations. Following these, the College Commandant—in conjunction with an external examiner appointed by the College and approved by the National Council—will submit to the Council his recommendations for the conferment of the Diploma in Technology (Engineering).

The eligibility of the College course for continued recognition for the Award will be reviewed by the Council every five years.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. A. Ingle, D.F.C., A.F.C., Gp. Capt. L. E. Giles, O.B.E., D.F.C., A.F.C., Wg. Cdr. K. B. Rogers, D.F.C., A.F.C., Wg. Cdr. E. K. Paine, and Sq. Ldr. E. J. A. Patterson, with acting rank of Wg. Cdr., to the Department of the Chief of the Air Staff; Wg. Cdr. F. J. Cuthill, Wg. Cdr. A. C. Hollingsworth, and Wg. Off. B. G. Martin, W.R.A.F., to the Department of the Air Member for Personnel; Gp. Capt. T. E. Burgess, Wg. Cdr. W. Hoy, D.F.C., A.F.C., and Wg. Cdr. D. P. Singleton to the Department of the Air Member for Supply and Organization.

Bomber Command: Wg. Cdr., J. A. Sowrey, D.F.C., A.F.C., to R.A.F. North Luffenham to command, with acting rank of Gp. Capt.; Wg. Cdr. A. W. Bower, D.F.C., to R.A.F. Hemswell to command the Administrative Wing; Wg. Cdr. R. Millhouse, M.B.E., R.A.F. Regiment, to Headquarters as Senior Ground Defence Staff Officer; Wg. Cdr. D. Roberts, D.F.C., A.F.C., to R.A.F. Gaydon as Chief Instructor

Fighter Command: Wg. Cdr. V. G. Owen-Jones, D.F.C., to R.A.F. Patrington as Wg. Cdr., Operations; Wg. Cdr. S. A. Vialls to Headquarters No. 12 Group, for operations duties.

Coastal Command: Wg. Cdr. D. L. Prichard, D.S.O., to Headquarters for Work Study duties; Wg. Cdr. G. F. Satchwell to R.A.F. Kinloss as Senior Technical Officer; Sqn. Ldr. D. T. Beamish to Headquarters as Command Marine Officer with acting rank of Wg. Cdr.

Transport Command: Gp. Capt. R. F. L. Hart to Headquarters as Gp. Capt., Organization.

Flying Training Command: Gp. Capt. R. G. Wakeford, O.B.E., A.F.C., to the R.A.F. Staff College, Bracknell, for Directing Staff duties; Wg. Cdr. C. L. W. Stewart, D.S.O., A.F.C., to No. 5 F.T.S., Oakington, to command, with acting rank of Gp. Capt.; Wg. Cdr. S. M. Davidson and Wg. Cdr. J. W. Frost, D.F.C., to the R.A.F. Staff College, Bracknell, for directing staff duties; Wg. Cdr. H. Grant, A.F.C., to the R.A.F. Selection Board, Cranwell, as Deputy President.

New Assistant Commandant

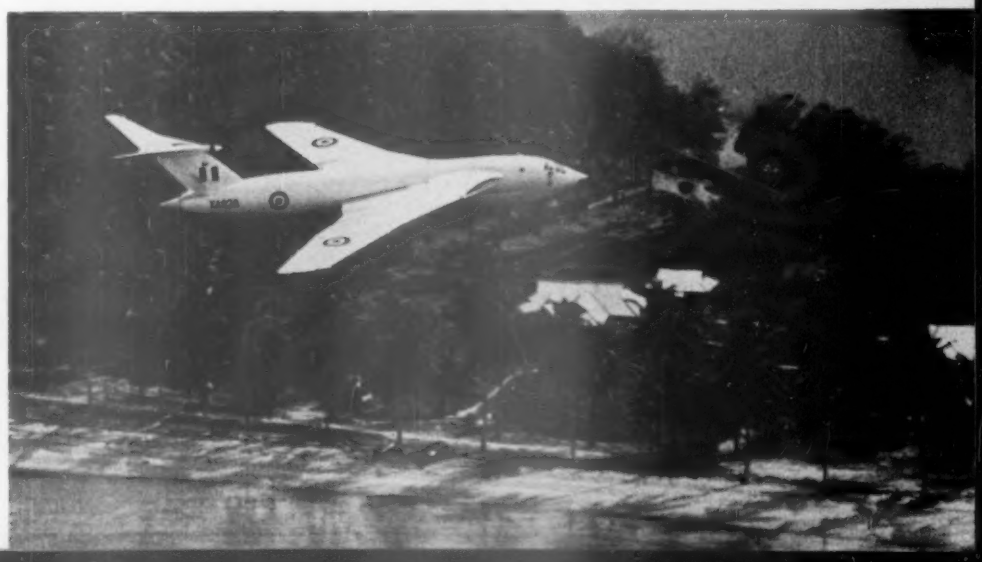
GROUP CAPTAIN T. P. SEYMOUR, who since 1957 has been R.A.F. Director at the Joint Anti-Submarine School at Londonderry, recently became Assistant Commandant at the R.A.F. College, Cranwell.

After taking the 1949 course at the R.A.F. Staff College, Bracknell, Gp. Capt. Seymour subsequently served at Headquarters, Bomber Command, and took the course at the R.A.F. Flying College, Manby. In 1954 he joined Headquarters, Aireastlant at Northwood for three years on Air Plans duties, and in 1957 took over command of No. 42 Squadron at St. Eval.

More Service News

No. 4 Squadron Reunion.—A reunion of No. 4 Squadron will be held at the R.A.F. Club, London, on Feb. 18. Any past or present members of the Squadron interested in attending should contact Flt. Lt. A. A. Boyle, R.A.F. Leuchars, Fife.

A.T.C. Pilots.—During the past 10 years some 2,500 A.T.C. cadets have gained private pilot's licences under the R.A.F. flying scholarship scheme. Since it started in 1950, 3,000 cadets have been selected for flying training, and of the 2,500 who have qualified for their P.P.L., 48% later joined the R.A.F. for flying duties.



F.E.A.F. VISITOR.—A Bomber Command Victor B.1 of No. 10 Squadron flying low over the coast of Malaya during a mobility exercise in the Far East from its base at R.A.F. Cottesmore.

M.E.A. Introduces Its Comets

by H. A. Taylor

THE entry of Comet 4Cs into service with Middle East Airlines on Jan. 6 represented the opening of a new era for this carrier and the culmination of a great deal of hard work and reorganization.

Preparations for the introduction by M.E.A. of turbojet transports have been in progress throughout most of the past year and the work has continued in parallel with the development of the company's new engineering base and headquarters on the north boundary of Beirut International Airport. This self-contained base, with its offices, workshops and two big hangars, was initially planned soon after MASCO (Mideast Aircraft Service Company) was formed in 1955. Since July, 1960, MASCO, as such, has been a property-holding company and the base has been an integral part of M.E.A.'s organization.

Operational development work in preparation for the Comets has, from the start, been handled by a small group of line pilots, assisted by a development engineer. As will be seen later, useful and interesting results have stemmed from this unique situation in which the thinking of active pilots has dominated the forward planning on the operational side.

Not the least of the problems for this comparatively small airline when introducing advanced new equipment has been concerned with the fact that its operating and engineering base is far from the normal centres of the aviation and airline industries. Consequently the engineering base has had to be most fully and completely equipped, so as to be independent of outside help, and the operational and crew-training planning has had to be progressed in this knowledge.

Training Philosophy

Obviously an airline of the present size of M.E.A. could not afford to install and operate a flight simulator. The crew-training programme, therefore, involves much more time in the air and on the routes than might otherwise be normal. This fact has distinct compensatory advantages; however valuable synthetic training may be, it cannot equal that which is obtainable in an aircraft. Quite apart from economics, M.E.A.'s operations department, led by Capt. J. Osborne, believes in "realistic" training methods—which, on the routes, cost no more than a training captain's time and salary—as the best possible insurance in terms of operational safety and regularity.

On the Viscounts the training has involved some 7-10 hours of base flying followed by about 100 hours on the routes under the eye of a training captain. For the Comets the base training period has been increased to 10 hours for captains and six for first officers. On the routes the initially selected captains are completing a minimum of 25 sectors (say, 65 hours); this requirement will be increased to 40 sectors (or about 100 hours) as the programme continues.

The normal M.E.A. flight deck crew for the Comet consists of two pilots and a flight engineer, and 34 pilots (out of a total of about 70) are being trained. All of them have more than 2,000 hours of Viscount flying and have the very valuable background of turbine experience and of the faster operating tempo which, together with accurate speed control, are among the principal requirements for the turbojet pilot. Partly because of the particular circumstances of the airline, its captains and first officers probably have longer experience than the average; an M.E.A. pilot has usually completed more than 9,000 hours before reaching command status.

The operational development and training programme in preparation for the Comets began in March last year. Before the first group of pilots went on de Havilland and Rolls-Royce technical courses (five weeks and one week respectively) and on B.O.A.C.'s Comet simulator (16 hours), "home study" courses were planned. Chosen captains each made a special

The first of M.E.A.'s four Comet 4Cs takes off on its initial test flight from Hatfield. The heading picture shows the same aircraft after delivery to Beirut.

study of a particular system or series of systems (say, hydraulics, electrics, or fuel) and worked up lectures to give to the other pilots. Thus, when they went on the technical courses—which are, after all and necessarily so, very much a series of "cramming" operations—they knew most of the questions and many of the answers.

Operations have started with two qualified M.E.A. captains, assisted by D.H. test pilots (John Cunningham and Peter Buggé) and by two B.O.A.C. captains. When, by about the end of April, six or seven M.E.A. pilots have completed their base training and route experience flying, the airline will be "on its own." Initially the Comets will operate between London and Beirut, via Geneva, and on to airports in the Persian Gulf area, where Kuwait will be included in the route when, in May, its new runway will have been completed. Later plans for the Comet include services to Madrid and Lisbon and, possibly, into South America.

Because M.E.A. will not, at turn-round points, have staff qualified to produce flight plans, these must be worked in the air on the preceding sector. One of the major tasks of the operations department has been the development, with the help of de Havilland, of a flight-planning system which would keep the work-load down to a minimum.

Simplified Flight Planning

The outcome has been the production of a unique series of tables with which, after a brief explanation, even I, as an inexperienced newcomer, could cope. The objects behind the development of these simplified flight-planning tables have been those of ensuring that they should be really quick in use and as near as possible to being foolproof without any practical loss of accuracy.

On the left, looking from the spectators' "gallery," is a busy scene on the apron at Beirut International.

Below, right, work proceeds on two Viscounts and a DC-3 in one of the two big hangars at M.E.A.'s new engineering base.

Photographs copyright "The Aeroplane and Astronautics"

The basis of the system lies in the use of standardized sector/diversion flight-time/fuel tables for either maximum-speed or maximum-range (stepped cruise) operations. Into these have been built all the consumption effects of normal take-off, climb and descent procedures. Upper-wind effects are adjusted in the tables by the use of an *air*-distance datum which has already been abstracted from two other tables using the forecast wind-speed and direction and the known sector distance.

Based on destination and alternate landing weights, the flight-planning tables are virtually complete in themselves and provide fuel/flight-time answers for both sector and diversion, assuming a fixed air temperature (jet standard +10° C. has been chosen in the case of M.E.A. operations), standard cruising techniques (whether M=0.76 indicated at 32,000 ft., or, for maximum range, M=0.70 indicated at 34,000 ft., with one step to 38,000 ft.), and standard associated climb and descent procedures.

A series of subsidiary tables are provided for making flight-time/fuel corrections for deviations from the standard in terms of quadrantal cruising altitude and upper-air temperature, and, for instance, minimum A.T.C.-required departure altitudes (from Cointrin, Geneva, the eastbound Comet must climb to 20,000 ft. before setting course) and departure/arrival aerodrome altitudes. In the case of the stepped long-range cruise, corrections are also made for variations in the initial quadrantal level.

Fixed fuel reserves—enough for 45 min. holding at 5,000 ft., plus, at least during the earlier period of Comet operation, an extra 1,000 kg.—are used by M.E.A. Because any diversion is assumed to have been made from overshoot, the alternate fuel is worked from the same tables as the sector fuel and another correction table gives the savings in fuel and time if the diversion is, in fact, started other than from ground level.

The flight-planning sum—which can normally, with these tables, be completed in about five minutes—is worked backwards from the landing weight at the alternate airport. To obtain this, the fixed fuel reserves (about 4,200 kg.) are added to the estimated zero-fuel weight. If there are no landing limitations at the alternate, this weight will be the starting point. Corrected fuel requirements (and flight time) for the diversion are then added to give the landing weight at the destination, and, using this as a restarting point, requirements (and flight time) for the sector can be read from the tables and added to destination weight to give the take-off weight and (including another 400 kg. for taxi-ing) the total fuel required.

All of which is an inevitable over-simplification of the sequence—but it will serve to demonstrate the comparative ease with which the work can be done. The concepts were primarily developed by Capt. I. G. Mason, M.E.A.'s navigation officer and a line captain, with the approval of de Havilland, whose computer was used to produce the tables. The operations manual, of which they form a part, carries all essential performance curves and information as well as tabulations of the fuel penalties to be expected when operating in icing conditions, corrections for the engine-out cases and appropriate aerodrome information.

The use of such a rationalized flight-planning system might not have been practical with turbojets other than the Comet, or on routes other than those of M.E.A. The Comet has no take-off-weight restriction problems at aerodromes on trunk routes, its payload is normally limited by volume and none of M.E.A.'s sector distances are critical in ordinary conditions. The maximum-speed procedure offers both minimum sector time and minimum operating costs. The long-range stepped cruise technique will be used only in abnormal conditions.

The operations department has also developed a simplified method of ensuring that the C.G. lies between the limits and a load-sheet similar to one which has been used by M.E.A. for its Viscounts during the past year. Like that for flight-planning, the loading procedure is, using a series of special tables, as near as possible to being foolproof. In simplest terms, the system makes use of the load in the aft fuselage hold (just forward of

Before the introduction of the Comet 4Cs, B.O.A.C. operated a twice-weekly service for M.E.A. with Comet 4s—from which the Alps are seen in this picture after the climb out of Cointrin, Geneva.

Photograph copyright "The Aeroplane and Astronautics"

the pressure bulkhead) as a means of correcting the trim throughout a sequenced loading procedure for the fuselage and the four underfloor holds. If the sequence is followed, the C.G. *must* be within the correct limits and the load-sheet is designed to make it easier for the signing pilot to see for himself that everything is in order.

Like many other airlines, M.E.A. has another little problem—that of keeping total fuel costs down when uplift prices vary from place to place. The operations department includes, in its basic sector fuel computation forms, guidance information about price differentials and (since it costs fuel to carry fuel) the extra load which can (or cannot) economically be taken aboard.

The Engineering Base

Essential to M.E.A.'s re-equipment programme is the new self-contained engineering base. Full-scale maintenance work started at this base at Beirut Airport in March, 1960, and it is not only self-contained but built on land which, with a large area for future expansion, is owned by MASCO/M.E.A.

Within the complex is a power house (with reserve diesel plant) and private (artesian well) water supply; the base includes a headquarters building, two hangars with office extensions and two workshop/test/inspection/stores groups. The hangars are 42 ft. high and are each capable of housing a Comet 4C, a Viscount and a DC-3. One is used primarily for line maintenance and minor checks; the other is used for major overhauls. The future-expansion land will permit the construction of two more hangars as and when these become necessary. M.E.A. looks after the day-to-day handling of the aircraft of eight or more airlines in addition to its own, and is at present doing major overhauls also for Kuwait Airways, Gulf Aviation and the Lebanese Air Force (Vampires and Hunters).

Because they are far from other main aviation centres, M.E.A.'s engineering and test facilities are necessarily very comprehensive by medium-sized airline standards, and it is not difficult to understand why it may be difficult to make ends meet when traffic fails, for various reasons, to provide the expected revenue. Continuously good business is necessary for the operation, maintenance and amortization of the kind and extent of equipment which the M.E.A. base must carry.

So far as its day-to-day work is concerned, M.E.A. has no reason for humility. Its Viscounts have recorded what is probably, for the type, the highest average utilizations yet. During last July the average was 9 hr. 35 min. a day (or 3,498 hours a year) and the figure for September was 9 hr. 7 min.

One of the two workshop groups, which is air-conditioned as appropriate, includes shops for radio, radar, instrument, autopilot and electrical equipment overhaul and test; for sheet metal and welding work; for propeller overhaul; for powerplant stripping and erection; and for hydraulic equipment overhaul and test. Much of the equipment and many of the test rigs have been designed and made by the MASCO/M.E.A. Basic work in the shops has involved the complete re-skinning of DC-3 wings and includes the regular replacement of the wing/centre-section joint structure of this aircraft.

The other unit in the workshop group was originally laid out for Dart engine overhaul and for the main stores. For various reasons—including the rapid increase in the inter-overhaul period for the Darts—the overhaul plan was dropped on economic grounds. That section of the building is now used principally as a ground-equipment overhaul and manufacturing shop. As an example of its work, this section has recently made a complete maintenance-dock unit for the Comet.

The engineering section of M.E.A. can be considered as being divided into five main groups: aircraft overhaul and line maintenance; component overhaul; inspection; planning; and supplies. There has always been a steady, if relatively small-scale, rotation of selected persons on courses of different kinds.

This International Aeradio plan of Beirut International shows the layout of the two runways in relation to the local topography.

This is an expensive business—but there is no short cut to, and near source of, suitable experience. Some 60-70 engineers have been on courses in the U.K., and a number of staff members have completed administrative and advisory courses—mainly at Glasgow University.

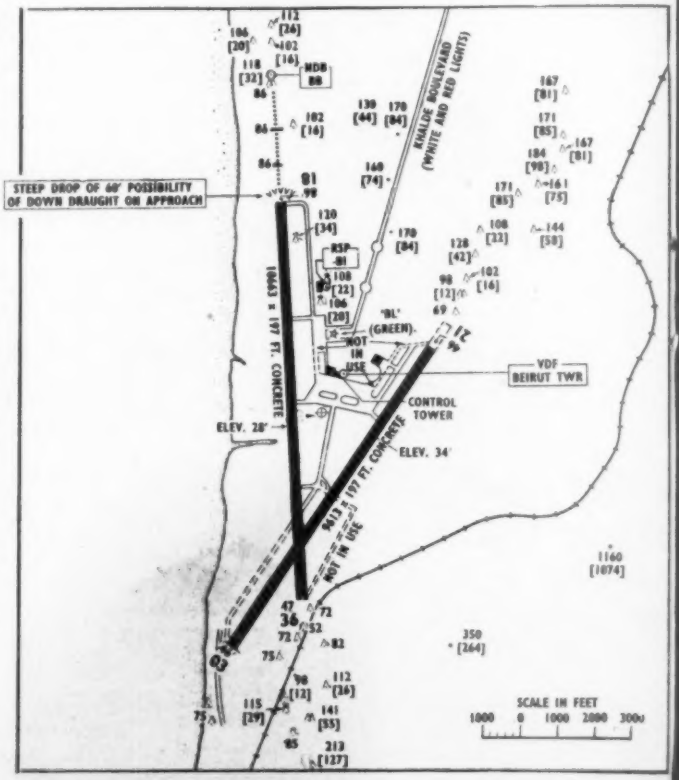
M.E.A. plans eventually, following the introduction of the Comets, to sell three of its Viscounts. The fleet will then consist of four Comet 4Cs, four Viscounts and four DC-3s, which will be used only for non-scheduled operations.

Airport Developments

Visually obvious changes at Beirut International Airport consist of extensions to the attractively monumental—and much photographed—terminal building, but other relatively minor developments are also in progress. New airline and other office blocks extending on the east and west sides of the main terminal are complete, or nearly so, and the main building has also been unobtrusively expanded on its "land"-side. This expansion will provide an additional area into which the concourse and traffic counters will be moved, leaving the old concourse area for use as a Customs-free shopping area. Other changes may include a freight/Customs centre on the site of the old M.E.A. engineering base which was leased from the authorities. A full hydrant (static) refuelling system for the apron is being laid down.

Less obvious changes include the installation of a VOR transmitter which is now on intermittent test. For siting reasons it lies to the south-east of the airport. On paper, Beirut's navigation facilities may seem to be limited, but, in fact, more sophisticated systems are unnecessary. The weather is normally good and any bad periods of cumulo-nimbus clouds and heavy showers are short-lived and localized. There were some earlier attempts to provide ILS facilities for the main 18/36 runway, but these were not successful in practice and the need was not such as to demand continued experiments. There is modified Calvert lead-in approach lighting to this runway, which is 10,663 ft. long; the other, 03/21, is 9,613 ft. long.

No runway extensions are planned. Although the midday temperature may be as high as I.S.A. + 15°C. for three months or so of the year, the airline sector distances out of Beirut are not normally such as to demand very high take-off weights for the turbojets and weight restrictions are necessary only when a big turbojet may be leaving on some very long-haul non-scheduled flight.



Industry Record

Dunlop and Aviation*

FIFTY years ago the Dunlop Pneumatic Tyre Co. made its first contribution to the then infant aircraft industry. In its catalogue for 1910 it advertised its first aeroplane tyres and wheels—and quoted the rims at 2s. 8d. each.

Dunlop's early aviation equipment was largely an adaptation from existing car and motorcycle tyres and wheels, and it is significant that in pre-1914 aeronautical literature, no mention is made of tyres or wheels beyond a reference that the aircraft may have had to land on sand or soft earth. The company's first development was the wired tyre in 1911 which was fitted to a well-based rim. The beaded-edge tyres previously used depended on inflation pressure to retain them on the wheel.

In 1912 the Coventry Ordnance Factory produced a biplane for the military trials and so far as can be ascertained this was fitted out by the company. The Army by then were becoming convinced of the aeroplane's usefulness and in 1913 the Blackburn Mercury was built. This aircraft was fitted with Dunlop tyres and four wheels.

During the 1914-18 War, the bulk of the company's resources were turned towards land vehicles, although towards the end of the War Dunlop was producing starter units for Rolls-Royce Eagle and cylinders for Gnôme et Rhône aero-engines. In 1919 the wheel section of Dunlop moved to part of its present site at Foleshill, Coventry; and in the years that followed the company began its close associations with aircraft constructors which brought about the formation of the Aviation Division as a separate unit in 1925.

By 1929 wire wheels were being replaced by disc wheels. In these, light-alloy discs were riveted to the rims and to fabricated or cast hubs containing phosphor-bronze bearing bushes. Based on a wheel load of 9,000 lb., the disc wheels were 10% lighter and 28% stronger than the spoked wheels.

Large aircraft seemed to be a feature of the early '30s and such types fitted with Dunlop equipment were the Handley Page Hannibal in 1930 and the Fokker monoplane in 1933.

Concurrently with work on wheel development, company technicians were trying to find answers to problems in the allied fields of tyres and brakes. Introduced in 1930, the first Dunlop differential brake was demonstrated on the Avro Avian. It consisted of a rubber tube, which when pressurized, forced segmented friction pads radially outward against a steel drum revolving with the wheel. In 1934 a hydraulic braking system was developed for light aircraft.

Over the years the design was further changed. Pressed-in brake drums were replaced with isolated drums to prevent heat transfer through the wheel structure to the tyres; and bi-metal brake drums were introduced in which iron was centrifugally cast into a mild steel shell to improve heat dissipation and prevent distortion. These brakes were used in all British fighters during the 1939-1945 War.

In 1934 Dunlop research workers also investigated the problem of how to conduct static electricity collected by aircraft. Work had been concentrated on tyres as they were the first part of the aircraft to come into contact with the ground. It was found that by incorporating a special form of carbon black into the rubber compound, the tyres could be made to conduct electricity.

A year later the Dunlop fluid anti-icing system was demonstrated in a Hawker Hunter and a Leopard Moth. The system consisted of gauze overshoes, fitted over the leading-edge surfaces of the wing and tailplane, through which de-icing fluid could be pumped.

In 1935 the international situation was deteriorating and at Coventry development began on gun-firing gear for aircraft. Although produced for the Spitfire and Hurricane prototypes, the Dunlop single pneumatic button for firing Browning machine guns was fitted first to Gloster Gauntlets and Gladiators.

By the time of the Battle of Britain, the eight guns of the Spitfire and Hurricane were all fired by the Dunlop single pneumatic button and cocking units. Introduction of the 20-mm. cannon involved further developments to allow selective use of either the heavier cannon or machine guns and the twin pneumatic button appeared on the scene.

At the end of the War, the Selectric gun-firing switch was in general use. This unit enabled the pilot to fire machine guns and cannon separately or together and also contained a camera switch for recording results.

One of the most important pre-War developments was the introduction of light-alloy castings in 1936, enabling lighter, larger wheels to be built to accommodate the bigger and more efficient brakes demanded by the improved performance of the newer aircraft. The large-section tyre evolved into an intermediate-pressure tyre resembling the large-section tyre in appearance but fitted to wheels of much greater diameter.

Many and varied were Dunlop's wartime developments. These included aircraft lifting bags; rubber dinghies, which saved the lives of 17,000 Allied airmen; rubber accessories and mountings; and self-sealing petrol tanks.

One outstanding wartime development was the Franks Anti-*g* flying suit. By the end of 1941, the first 50 suits, made in three sizes, were ready for trial, but further research caused modifications. By June, 1942, Dunlop were producing the F.F.S. Mark IIF. It was first used operationally in the North African Landings in November, 1942.

Towards the end of the 1939-45 War the thinner wings of high-speed aircraft offered less space for undercarriage retraction and this smaller space necessitated smaller wheels. At the same time landing and take-off speeds were much higher, all of which imposed greater stresses on the small tyre. Generally these problems were overcome by using smaller tyres at high pressure.

The same problem faced the company's brake designers. In 1946 the plate brake was designed which eliminated the brake drum, and in 1951, the Maxaret anti-skid unit was produced.

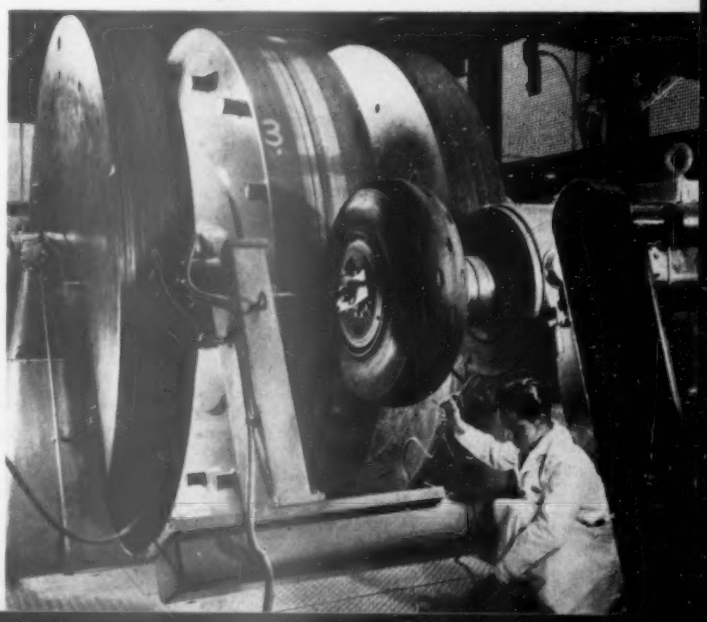
Dunlop moved into the missile field in 1953, providing equipment for the Fairey Fireflash and other early production missiles. Today components are used in the de Havilland Firestreak and the Avro Blue Steel for propulsion, guidance and armament.

In 1953 the adjoining and disused Jaguar car factory was acquired to enlarge production facilities. Production of electro-thermal de-icing elements began there on a large scale for engine intakes, etc. Then a year later the company introduced the propeller brake.

The constant attention to research and development naturally requires considerable research and testing facilities. In 1956 an Adamson dynamometer was installed in the aviation test house among the other dynamometers, fatigue-measuring machines and research equipment.

About two years ago, Dunlop introduced two improvements to wheel design. The first was the air-cooled brake—fitted to B.O.A.C. Comet 4s. The second was the introduction of fusible plugs to provide a safety measure against excessive heat damaging tyre beads. By last year the majority of high-performance aircraft was using tubeless tyres.

* Extracted from a survey prepared by the company to commemorate its Jubilee.



The Adamson dynamometer at the Aviation Division of the Dunlop Rubber Co., Ltd., at Coventry. The temperature of a tyre is being recorded immediately following a braking test on the machine.

Before the introduction of the Comet 4Cs, B.O.A.C. operated a twice-weekly service for M.E.A. with Comet 4s—from which the Alps are seen in this picture after the climb out of Cointrin, Geneva.

Photograph copyright "The Aeroplane and Astronautics"

the pressure bulkhead) as a means of correcting the trim throughout a sequenced loading procedure for the fuselage and the four underfloor holds. If the sequence is followed, the C.G. *must* be within the correct limits and the load-sheet is designed to make it easier for the signing pilot to see for himself that everything is in order.

Like many other airlines, M.E.A. has another little problem—that of keeping total fuel costs down when uplift prices vary from place to place. The operations department includes, in its basic sector fuel computation forms, guidance information about price differentials and (since it costs fuel to carry fuel) the extra load which can (or cannot) economically be taken aboard.

The Engineering Base

Essential to M.E.A.'s re-equipment programme is the new self-contained engineering base. Full-scale maintenance work started at this base at Beirut Airport in March, 1960, and it is not only self-contained but built on land which, with a large area for future expansion, is owned by MASCO/M.E.A.

Within the complex is a power house (with reserve diesel plant) and private (artesian well) water supply; the base includes a headquarters building, two hangars with office extensions and two workshop/test/inspection/stores groups. The hangars are 42 ft. high and are each capable of housing a Comet 4C, a Viscount and a DC-3. One is used primarily for line maintenance and minor checks; the other is used for major overhauls. The future-expansion land will permit the construction of two more hangars as and when these become necessary. M.E.A. looks after the day-to-day handling of the aircraft of eight or more airlines in addition to its own, and is at present doing major overhauls also for Kuwait Airways, Gulf Aviation and the Lebanese Air Force (Vampires and Hunters).

Because they are far from other main aviation centres, M.E.A.'s engineering and test facilities are necessarily very comprehensive by medium-sized airline standards, and it is not difficult to understand why it may be difficult to make ends meet when traffic fails, for various reasons, to provide the expected revenue. Continuously good business is necessary for the operation, maintenance and amortization of the kind and extent of equipment which the M.E.A. base must carry.

So far as its day-to-day work is concerned, M.E.A. has no reason for humility. Its Viscounts have recorded what is probably, for the type, the highest average utilizations yet. During last July the average was 9 hr. 35 min. a day (or 3,498 hours a year) and the figure for September was 9 hr. 7 min.

One of the two workshop groups, which is air-conditioned as appropriate, includes shops for radio, radar, instrument, autopilot and electrical equipment overhaul and test; for sheet metal and welding work; for propeller overhaul; for powerplant stripping and erection; and for hydraulic equipment overhaul and test. Much of the equipment and many of the test rigs have been designed and made by the MASCO/M.E.A. Basic work in the shops has involved the complete re-skinning of DC-3 wings and includes the regular replacement of the wing/centre-section joint structure of this aircraft.

The other unit in the workshop group was originally laid out for Dart engine overhaul and for the main stores. For various reasons—including the rapid increase in the inter-overhaul period for the Darts—the overhaul plan was dropped on economic grounds. That section of the building is now used principally as a ground-equipment overhaul and manufacturing shop. As an example of its work, this section has recently made a complete maintenance-dock unit for the Comet.

The engineering section of M.E.A. can be considered as being divided into five main groups: aircraft overhaul and line maintenance; component overhaul; inspection; planning; and supplies. There has always been a steady, if relatively small-scale, rotation of selected persons on courses of different kinds.

This International Aeradio plan of Beirut International shows the layout of the two runways in relation to the local topography.

This is an expensive business—but there is no short cut to, and near source of, suitable experience. Some 60-70 engineers have been on courses in the U.K., and a number of staff members have completed administrative and advisory courses—mainly at Glasgow University.

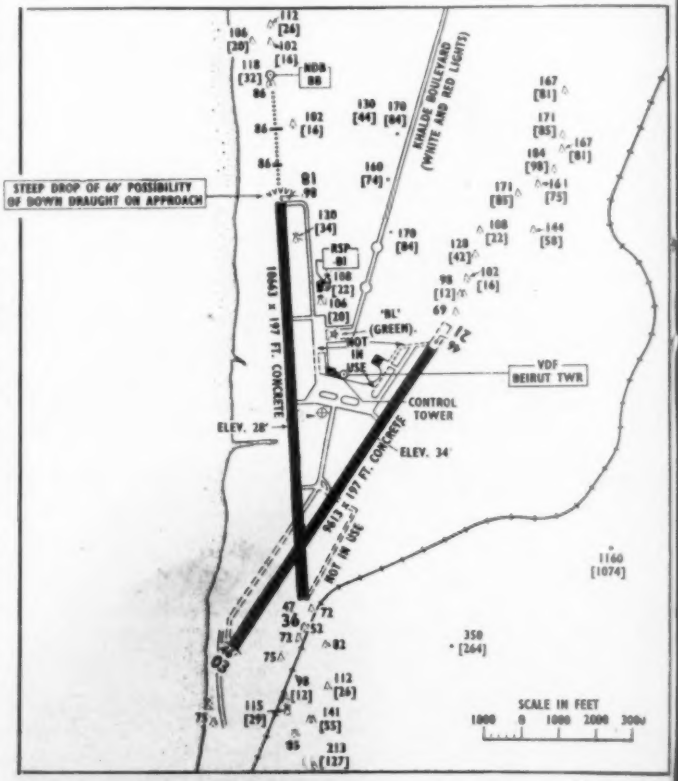
M.E.A. plans eventually, following the introduction of the Comets, to sell three of its Viscounts. The fleet will then consist of four Comet 4Cs, four Viscounts and four DC-3s, which will be used only for non-scheduled operations.

Airport Developments

Visually obvious changes at Beirut International Airport consist of extensions to the attractively monumental—and much photographed—terminal building, but other relatively minor developments are also in progress. New airline and other office blocks extending on the east and west sides of the main terminal are complete, or nearly so, and the main building has also been unobtrusively expanded on its "land"-side. This expansion will provide an additional area into which the concourse and traffic counters will be moved, leaving the old concourse area for use as a Customs-free shopping area. Other changes may include a freight/Customs centre on the site of the old M.E.A. engineering base which was leased from the authorities. A full hydrant (static) refuelling system for the apron is being laid down.

Less obvious changes include the installation of a VOR transmitter which is now on intermittent test. For siting reasons it lies to the south-east of the airport. On paper, Beirut's navigation facilities may seem to be limited, but, in fact, more sophisticated systems are unnecessary. The weather is normally good and any bad periods of cumulo-nimbus clouds and heavy showers are short-lived and localized. There were some earlier attempts to provide ILS facilities for the main 18/36 runway, but these were not successful in practice and the need was not such as to demand continued experiments. There is modified Calvert lead-in approach lighting to this runway, which is 10,663 ft. long; the other, 03/21, is 9,613 ft. long.

No runway extensions are planned. Although the midday temperature may be as high as I.S.A. + 15°C. for three months or so of the year, the airline sector distances out of Beirut are not normally such as to demand very high take-off weights for the turbojets and weight restrictions are necessary only when a big turbojet may be leaving on some very long-haul non-scheduled flight.



Industry Record

Dunlop and Aviation*

FIFTY years ago the Dunlop Pneumatic Tyre Co. made its first contribution to the then infant aircraft industry. In its catalogue for 1910 it advertised its first aeroplane tyres and wheels—and quoted the rims at 2s. 8d. each.

Dunlop's early aviation equipment was largely an adaptation from existing car and motorcycle tyres and wheels, and it is significant that in pre-1914 aeronautical literature, no mention is made of tyres or wheels beyond a reference that the aircraft may have had to land on sand or soft earth. The company's first development was the wired tyre in 1911 which was fitted to a well-based rim. The beaded-edge tyres previously used depended on inflation pressure to retain them on the wheel.

In 1912 the Coventry Ordnance Factory produced a biplane for the military trials and so far as can be ascertained this was fitted out by the company. The Army by then were becoming convinced of the aeroplane's usefulness and in 1913 the Blackburn Mercury was built. This aircraft was fitted with Dunlop tyres and four wheels.

During the 1914-18 War, the bulk of the company's resources were turned towards land vehicles, although towards the end of the War Dunlop was producing starter units for Rolls-Royce Eagle and cylinders for Gnôme et Rhône aero-engines. In 1919 the wheel section of Dunlop moved to part of its present site at Foleshill, Coventry; and in the years that followed the company began its close associations with aircraft constructors which brought about the formation of the Aviation Division as a separate unit in 1925.

By 1929 wire wheels were being replaced by disc wheels. In these, light-alloy discs were riveted to the rims and to fabricated or cast hubs containing phosphor-bronze bearing bushes. Based on a wheel load of 9,000 lb., the disc wheels were 10% lighter and 28% stronger than the spoked wheels.

Large aircraft seemed to be a feature of the early '30s and such types fitted with Dunlop equipment were the Handley Page Hannibal in 1930 and the Fokker monoplane in 1933.

Concurrently with work on wheel development, company technicians were trying to find answers to problems in the allied fields of tyres and brakes. Introduced in 1930, the first Dunlop differential brake was demonstrated on the Avro Avian. It consisted of a rubber tube, which when pressurized, forced segmented friction pads radially outward against a steel drum revolving with the wheel. In 1934 a hydraulic braking system was developed for light aircraft.

Over the years the design was further changed. Pressed-in brake drums were replaced with isolated drums to prevent heat transfer through the wheel structure to the tyres; and bi-metal brake drums were introduced in which iron was centrifugally cast into a mild steel shell to improve heat dissipation and prevent distortion. These brakes were used in all British fighters during the 1939-1945 War.

In 1934 Dunlop research workers also investigated the problem of how to conduct static electricity collected by aircraft. Work had been concentrated on tyres as they were the first part of the aircraft to come into contact with the ground. It was found that by incorporating a special form of carbon black into the rubber compound, the tyres could be made to conduct electricity.

A year later the Dunlop fluid anti-icing system was demonstrated in a Hawker Hunter and a Leopard Moth. The system consisted of gauze overshoes, fitted over the leading-edge surfaces of the wing and tailplane, through which de-icing fluid could be pumped.

In 1935 the international situation was deteriorating and at Coventry development began on gun-firing gear for aircraft. Although produced for the Spitfire and Hurricane prototypes, the Dunlop single pneumatic button for firing Browning machine guns was fitted first to Gloster Gauntlets and Gladiators.

By the time of the Battle of Britain, the eight guns of the Spitfire and Hurricane were all fired by the Dunlop single pneumatic button and cocking units. Introduction of the 20-mm. cannon involved further developments to allow selective use of either the heavier cannon or machine guns and the twin pneumatic button appeared on the scene.

At the end of the War, the Selectric gun-firing switch was in general use. This unit enabled the pilot to fire machine guns and cannon separately or together and also contained a camera switch for recording results.

One of the most important pre-War developments was the introduction of light-alloy castings in 1936, enabling lighter, larger wheels to be built to accommodate the bigger and more efficient brakes demanded by the improved performance of the newer aircraft. The large-section tyre evolved into an intermediate-pressure tyre resembling the large-section tyre in appearance but fitted to wheels of much greater diameter.

Many and varied were Dunlop's wartime developments. These included aircraft lifting bags; rubber dinghies, which saved the lives of 17,000 Allied airmen; rubber accessories and mountings; and self-sealing petrol tanks.

One outstanding wartime development was the Franks Anti-*g* flying suit. By the end of 1941, the first 50 suits, made in three sizes, were ready for trial, but further research caused modifications. By June, 1942, Dunlop were producing the F.F.S. Mark IIF. It was first used operationally in the North African Landings in November, 1942.

Towards the end of the 1939-45 War the thinner wings of high-speed aircraft offered less space for undercarriage retraction and this smaller space necessitated smaller wheels. At the same time landing and take-off speeds were much higher, all of which imposed greater stresses on the small tyre. Generally these problems were overcome by using smaller tyres at high pressure.

The same problem faced the company's brake designers. In 1946 the plate brake was designed which eliminated the brake drum, and in 1951, the Maxaret anti-skid unit was produced.

Dunlop moved into the missile field in 1953, providing equipment for the Fairey Fireflash and other early production missiles. Today components are used in the de Havilland Firestreak and the Avro Blue Steel for propulsion, guidance and armament.

In 1953 the adjoining and disused Jaguar car factory was acquired to enlarge production facilities. Production of electro-thermal de-icing elements began there on a large scale for engine intakes, etc. Then a year later the company introduced the propeller brake.

The constant attention to research and development naturally requires considerable research and testing facilities. In 1956 an Adamson dynamometer was installed in the aviation test house among the other dynamometers, fatigue-measuring machines and research equipment.

About two years ago, Dunlop introduced two improvements to wheel design. The first was the air-cooled brake—fitted to B.O.A.C. Comet 4s. The second was the introduction of fusible plugs to provide a safety measure against excessive heat damaging tyre beads. By last year the majority of high-performance aircraft was using tubeless tyres.

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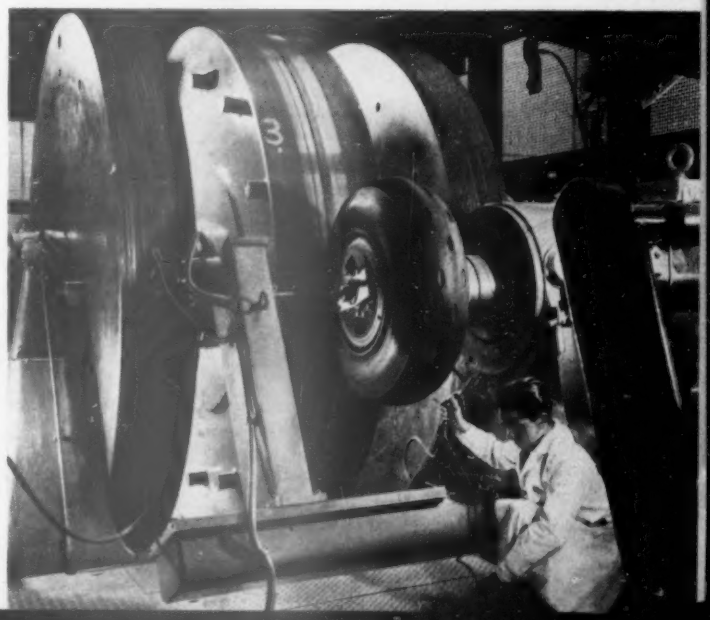


The Adamson dynamometer at the Aviation Division of the Dunlop Rubber Co., Ltd., at Coventry. The temperature of a tyre is being recorded immediately following a braking test on the machine.

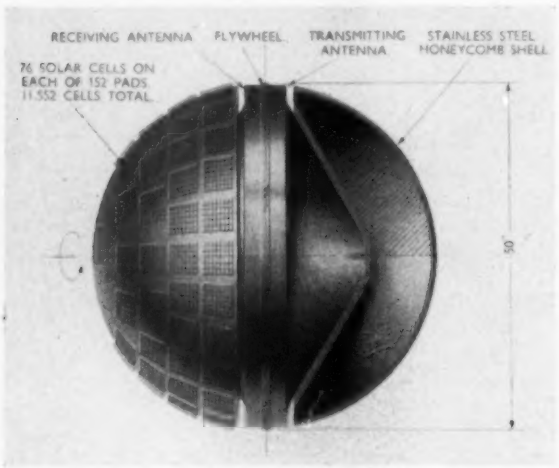
Orbital Relay Stations

PROSPECTS of Blue Streak becoming the first stage of a European heavy-satellite launcher have focused attention upon the types of payload it may be developed to carry. Almost certainly, the scientists will get their stabilized satellite for astronomical studies. Elliott Brothers (London), Ltd., have been working for some time on a stabilized platform in conjunction with the R.A.E.

The key to many advanced applications of satellites is, of course, closely bound up with the ability of space-vehicles to keep their equipment effectively locked on a particular objective. In the case of an astronomical telescope, this may be the Sun, a star or a planet; a reconnaissance or meteorological satellite will need to keep its cameras and other sensing equipment pointed at the Earth; while an advanced communications satellite will require the same facility for its directional antennæ.

Satellite Communications

Interest in communication satellites has been growing apace in recent months on both sides of the Atlantic and there can be little doubt that Britain will be taking an active part in this work, both for civil and military applications. In the House of Commons on Dec. 21, Mr. Rippon, Parliamentary Secretary, Ministry of Aviation, said that there had been "preliminary talks with our friends in Canada and the United States, and the Postmaster-General is hopeful of being able to take part in very valuable tests. I hope that will be within the next year or so. We envisage putting two or three satellites into polar orbit."



The spin-stabilized 175-lb., 50-in. diameter active communication satellite proposed by A.T. & T. It is intended for launching into a polar orbit at 2,500 to 3,000 miles. Fifty such satellites are envisaged for a comprehensive global communications system (Ref. 2).

The time-scale envisaged in this statement appears to suggest the use of an American launcher in agreement with NASA. The U.S. civilian space agency has already promised an early demonstration of the "technical feasibility of very lightweight active repeater-satellites to be placed in orbit at 3,000 to 5,600 miles."

It will also support technically promising private proposals on a cost-reimbursement basis. This means that the space agency will, to the extent of its statutory authority, make vehicles, launching and tracking facilities and technical services available at cost to U.S. private companies.

If we can arrange to co-operate in a research and development programme of this kind with NASA on an information-sharing basis, this would be beneficial both to ourselves and the Americans, for it would, of course, involve the operation of satellites and their attendant ground stations on both sides of the Atlantic.

Thanks to the initiative of Hawker Siddeley Aviation in preparing Britain's first detailed design study for a stabilized communication satellite (Ref. 1), we are already in a position to begin work on an advanced satellite concept in conjunction with the British electronics industry. First American satellites will be less "sophisticated," without directional antennæ, and this scheme may give us the chance of effectively entering the field of satellite communication within the time-scale envisaged for the development of the European launcher.

DESIGN PARAMETERS OF A.T. & T. ACTIVE SATELLITE REPEATER SYSTEM

Experimental path	U.S.A. (Holmdel)—Europe (Paris)
Satellite, altitude	2,500 miles
orbit	circular polar
period	2 hr. 55 min.
velocity	14,450 m.p.h.
Mutual visibility time, best pass	approx. 30 min. 7-1/2° above horizon
Maximum range to satellite	4,600 miles
Maximum path loss	130 db
Minimum range to satellite	2,500 miles
Minimum path loss (reference value)	125 db
Ground antenna effective area	1,700 ft² (60 ft. dish)
Temperature of ground receiver	30° K
Noise in 10-mc band	—144 dbw
Power of ground transmitter	1 kw
Satellite antenna	Isotropic - 3 db
Temperature of satellite receiver	3000° K.
Noise in 100-mc band	—114 dbw
Power of satellite transmitter	1 watt

Particular attention must, of course, be given in any satellite system to ensuring long-life operation, if it is to compete effectively with well-tried and more conventional communication techniques. The required standard may not be reached for many years, and it is this single factor that gives us our opportunity to make worthwhile contributions despite our late start.

U.S. Private Industry Proposals

In the United States, private industry has already reached the hardware stage in communication satellites. On Oct. 21 last year, for example, the American Telephone and Telegraph Company applied to the U.S. Government's Federal Communication Commission for permission to place a 175-lb. active repeater satellite in orbit "within a year." The initial satellite would be capable of handling transmissions of up to 35 min. duration three or four times a day.

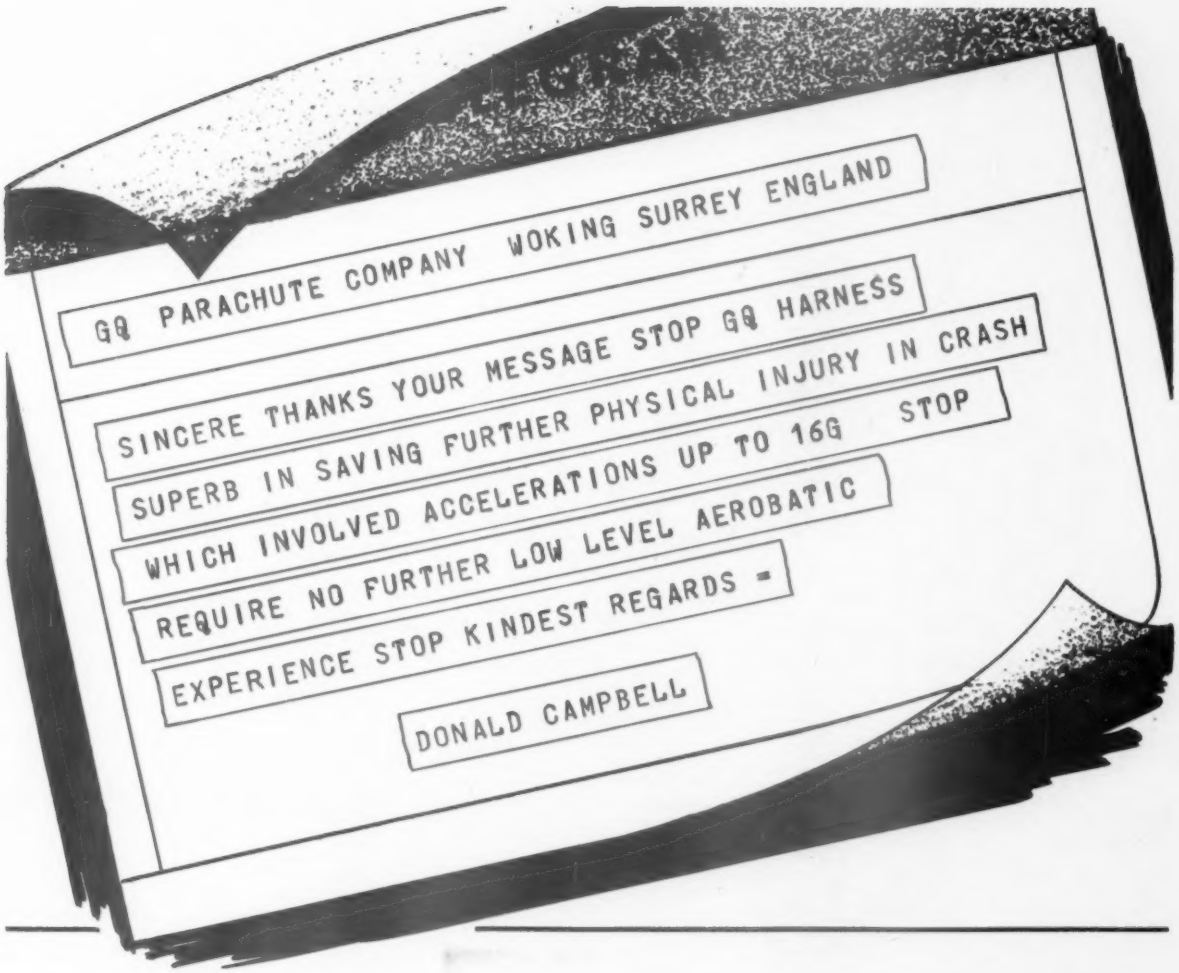
From this beginning it is proposed to develop a network of 50 satellites on random polar orbits at some 2,500 miles altitude. This would provide a comprehensive global communications system (Ref. 2).

The simplicity of the actual satellite is apparent from the accompanying drawing. For example, orientation or station-keeping devices are not considered necessary for initial experiments, spin-stabilization "being satisfactory for dipole antennæ." The satellites will each have slightly different orbital periods so that, by chance, almost always at least one satellite will be mutually visible at two ground stations.

Although this "saturation" technique may seem extremely

(*Continued on page 45*)

Spin-testing the 32-lb., 29-in. dia., active communications satellite developed by Hughes Aircraft Company. It is intended to relay "hundreds of telephone calls and TV signals between continents" from a stationary orbit 22,300 miles above the equator. Mounted on the rim are 2,700 solar cells.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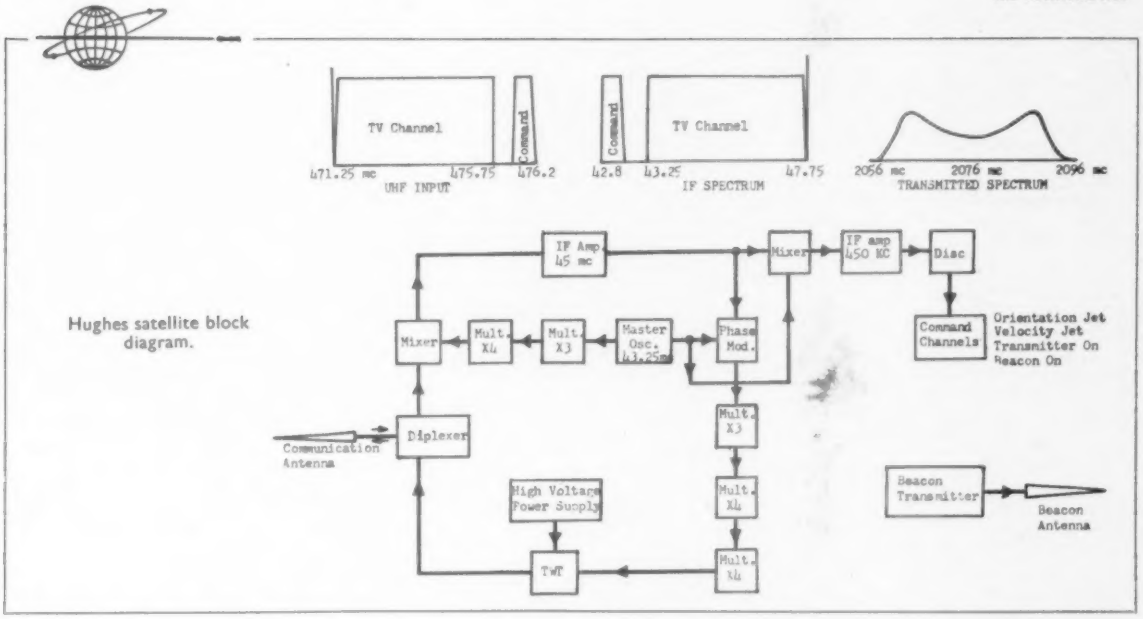


Hughes satellite block diagram.

(*Continued from page 44*)

wasteful, A.T. and T.'s argument is that, at this early stage, simplification of the satellite's design may render the overall system more economical than the use of fewer satellites which embody orientation and station-keeping equipment, but which, because of their relatively greater weight and complexity, require larger boosters and may be liable to early failure in orbit.

"Stationary" Orbit

Another satellite proposal has recently come from the Hughes Aircraft Company which, like that of A.T. and T., is directed towards maximum simplicity in the satellite and swift technical development. The Hughes proposal is remarkable in two ways. First, the satellite is intended for a 24-hr. synchronous equatorial orbit at 22,300 miles altitude; second, its total weight is only 32 lb.

Incredible as it may seem, Hughes is advocating that the vehicle should be launched into orbit by an adaptation of the economical four-stage, solid-propellent, Scout rocket. Proposed launching site is Jarvis Island, which is almost on the line of the Equator in the Central Pacific.

In this scheme the Hughes company, like A.T. and T., does not envisage the use of an Earth-orientated satellite and antenna. This, it is emphasized, inevitably leads to a high payload weight and the need for a large, expensive rocket booster.

In the Hughes system, sufficient antenna directivity is achieved through the use of a "pancake" beam. This permits the satellite to be spin-stabilized with its axis parallel to the Earth's axis.

Method of injection into orbit is shown in the accompanying diagrams. When the satellite separates from the carrier rocket's final stage, its spin-axis—which, at this point, is horizontal to the Earth's surface—is re-orientated parallel to the Earth's axis of rotation, so as to achieve continuous high antenna gain during operation of the repeater. Precession to the desired orientation is achieved by pulsing the attitude control jet in synchronism with the axial spin.

The attitude jet, which has a 12-in. moment arm about the C.G., delivers a thrust which is parallel to the spin axis. The attitude is sensed relative to the Sun during precession. Synchronized pulsing for 60° of each revolution, using "bleep" signals from a solar sensor, and a synchronous controller to generate ground commands, provides the necessary torque in a controlled direction in space.

Use of these techniques, and an integrated electronic design in which the communications repeater serves also as a guidance signal repeater, a command receiver, and a telemetering transmitter, has resulted in the phenomenally low payload weight of 32 lb. Of this, the electronics package contributes less than 5 lb., which includes the systems travelling-wave tube. The repeater consists of a transistorized UHF receiver and L-band (2-kmc) transmitter having a power output of 2.5 W. This provides 8 db. gain, and 14 db. or more is envisaged in advanced designs.

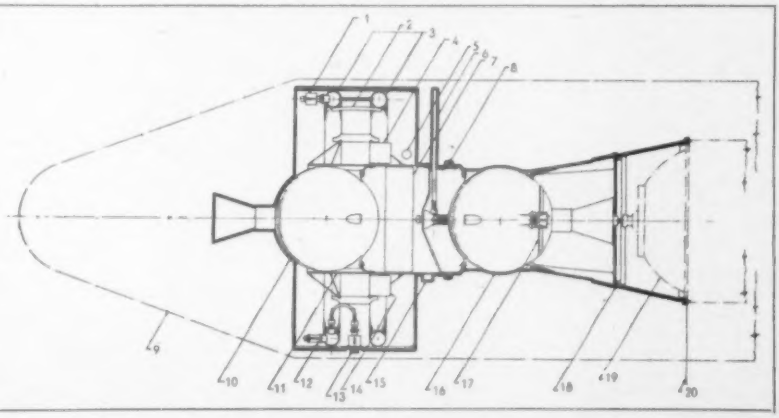
Hughes emphasized that use of single side-band on the Earth-to-payload link permits the superimposition of signals from a large number of gound stations on a frequency-sharing basis, while minimizing the bandwidth requirement. A unique type of phase-modulator serves for economy of power in the satellite, electricity being supplied by 2,700 solar cells mounted on the rim of the vehicle.

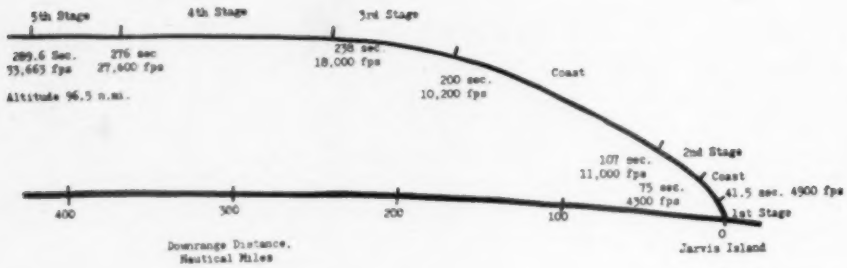
The intention is to establish a satellite in a 24-hr. orbit some 22,300 miles above the mouth of the River Amazon. At this position and altitude, the satellite will appear to remain fixed in the sky, keeping pace with the Earth's rotation, and should be "visible" to ground stations throughout most of North and South America, Western Europe and the Western half of

INSTALLATION OF HUGHES SATELLITE IN SCOUT BOOSTER

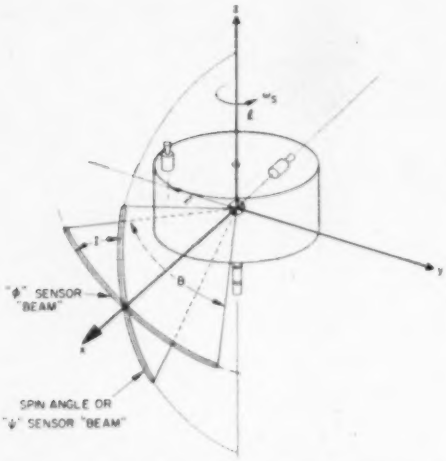
KEY:

1. Orientation nozzle.
2. Nutation damper.
3. Nitrogen tanks.
4. High voltage power supply.
5. Travelling-wave tube.
6. Dipole antenna (folded).
7. Electronic unit.
8. Separation clamp (5th stage).
9. Jettisonable nose-cone (Scout vehicle).
10. 6th stage 11.2-in. spherical motor.
11. Canister.
12. Filler valve.
13. Velocity control nozzle and valve.
14. Battery.
15. Umbilical.
16. 5th stage 11.2-in. spherical motor.
17. Thrust cut-off separation ring.
18. Separation clamp (satellite).
19. 4th stage Altair motor (Scout vehicle).
20. Altair motor mounting surface.

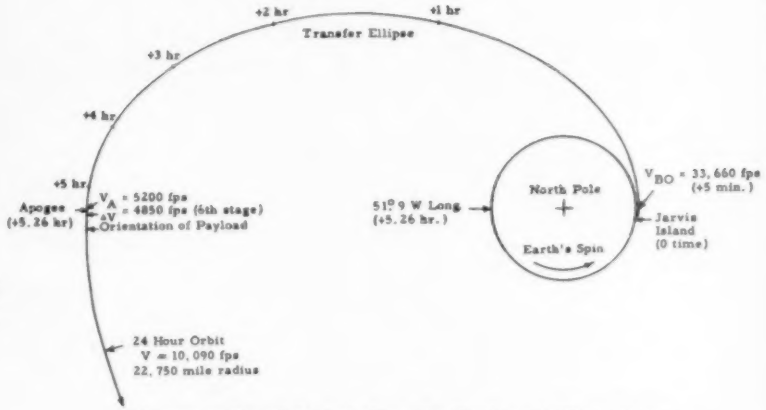




Left, Hughes proposed booster trajectory assuming equatorial launching by a Scout variant from Jarvis Island (Central Pacific). Below, transfer orbit to 24-hr. synchronous orbit at approximately 22,300 miles.



Geometry of the 32-lb. Hughes satellite. Flat beam (0°.6 × 180°) of first solar sensor (ψ) is parallel to spin axis, giving spin phase information for pulsing of attitude and velocity control jets. Second sensor (φ), with beam inclined at angle I=35°, provides second beam of "V-beam system" which measures angle between spin-axis and payload-sun line. Time delay in command pulsing is compensated by use of transponded signals from synchronous controller.



Africa. According to Hughes, it is planned to provide "hundreds of telephone circuits and direct television transmission."

One disadvantage of the "stationary" repeater is that unless it is placed with great precision in a circular orbit at the appointed altitude, and something is done to correct for perturbations, it will tend to drift out of position. For telephonic communication, its relatively great distance from the Earth (about 22,300 miles) will also involve a significant delay in communication as the propagation time to and from the repeater is about 0.3 sec. This means that a speaker cannot receive a reply to a remark for about 0.6 sec.

These are, however, problems for the future. As a first demonstration of the technique, the Hughes satellite may represent a milestone in the development of communication satellites. If present plans materialize, there are hopes of launching a flightweight prototype this year into an inclined equatorial orbit from Cape Canaveral.

WEIGHT DATA (HUGHES SATELLITE)

TOTAL PAYLOAD, 27.23 lb. (comprising: electronics, 4.0; travelling-wave tube, 0.75; spokes and clamps, 0.28; antenna, 0.5; control valves, 1.0; nitrogen, 4.06; tanks, 5.9; nutation damper, 0.1; control fittings and tubing, 0.5; battery, 1.9; solar cells, 4.0; electrical wiring umbilical, 0.2; canister, 1.5; canister cover, 0.25; canister rings, 0.02; antenna mounting, 0.19; cylinder, 1.87; sixth-stage motor mountings, 0.05; antenna ground surface, 0.27).

SATELLITE, including terminal staging, 32.05 lb. (comprising: payload, 27.23; sixth-stage motor lugs, 0.25; sixth-stage inert weight, 4.57).

TOTAL AT SIXTH-STAGE BURN-OUT, 62.07 lb. (comprising: satellite, 32.05; fifth-stage burn-out, 4.57; thrust cut-off, 0.5; mounting lugs, 0.5; separation ring, 0.5; sixth-stage propellent, 23.95).

TOTAL DESIGN WEIGHT, 100 lb. (comprising: total at sixth-stage burn-out, 62.07; fifth-stage propellent, 36.93; satellite support structure, 0.5; weight added to Altair, 0.5).

REFERENCES

(1) Hilton, W. F., "A Projected Communications Satellite," THE AEROPLANE AND ASTRONAUTICS, Aug. 12, 1960, pp. 182-184.

(2) "Space-age Struggles," THE AEROPLANE AND ASTRONAUTICS, Nov. 4, 1960, pp. 602-3.

Space Programme Views

USE of a French rocket vehicle as a second-stage for Blue Streak instead of Black Knight would inevitably delay a British space programme, although clearly work must be shared out if Britain is to undertake a programme in collaboration with other countries. This view was expressed by Mr. A. V. Cleaver at the Royal Aeronautical Society last week when the R.Ae.S. astronautics and guided flight section was shown three films about Black Knight, Blue Streak and communications satellites. The latest official estimate for launching a satellite with Blue Streak and a French second stage is "in the next five to six years"; this time scale was mentioned in Parliament on Dec. 21 by Mr. Geoffrey Rippon, M.o.A. Parliamentary Secretary.

Discussing the likelihood of a French second stage being used with Blue Streak, Mr. G. K. C. Pardoe, of de Havilland, said that an unknown factor was how far the French rocket had progressed into the development and hardware stage. It was believed to be at a very early stage of development.

On the other hand, Black Knight was by no means the optimum second stage for Blue Streak when used as a satellite launcher. If it were not used, there was the possibility of developing a high-energy upper stage. There was also considerable scope for developing Blue Streak; its thrust could be increased considerably.

Some interesting points emerged from the Blue Streak film and Mr. Pardoe's remarks about it. Work on the project has continued since the cancellation of Blue Streak as a missile. The aim has been to maintain progress, but without excessive expenditure. At Woomera the heavy engineering on launch-pad facilities is nearly complete and electrical and other equipment is ready to be installed. Range facilities have been set up for Blue Streak and one missile is already at Woomera.

Mr. Pardoe said that it would cost about £1 million to put a satellite into orbit using a three-stage vehicle based on Blue Streak. This covered hardware cost of the vehicle plus an allowance for transport and trials teams; it did not allow for any share of the missile's R. and D. costs.

Dr. W. F. Hilton, of Hawker Siddeley, discussed the film on communications satellites. This described the company's well-known scheme for using satellites in elliptic orbits. He said that the cost of a satellite depended mainly on the cost of its solar cells. The price of these cells today was £1 million per kilowatt generated.

Some of his views were challenged by other speakers. For instance, Dr. Hilton spoke of injecting satellites with a velocity accurate to 10 ft./sec. Both Mr. Pardoe and Mr. Robinson of the R.A.E. considered that greater accuracy was essential, up to 1/100 ft./sec. in Mr. Robinson's view. He also queried Dr. Hilton's assumption that satellites with a 300-mile perigee would have a life of 25 years; he considered that air drag would limit their life to about a year.

Aviation News in General

R.A.E. "AT HOME".—Open Days are planned at the Royal Aircraft Establishment, Farnborough, on Friday and Saturday, Jne. 2 and 3. On the Friday, the Establishment will be open to technical visitors; on the Saturday, relatives and guests of R.A.E. employees will be invited. Admission will be by ticket only.

SOVIET IMPORT.—Ordered after Mr. Krushchev's visit to the U.S. in 1959, two Sikorsky S-58s and two Vertol 44s have now been delivered to Russia. The S-58s and one Vertol are for executive duties, the other Vertol having a standard airline interior.

ITALIAN PRODUCTION.—First production AerMacchi MB.326 jet trainers are now ready for delivery to the Italian Air Force. Current orders cover 31 aircraft but total requirements have been stated to be around 120. First Italian-built Lockheed-Macchi CL-402 Santa Maria is expected to fly this year.

VISCOUNT TRIAL.—Following extension to the runway at Golden Rock Airport, St. Kitts, B.W.I.A. recently made a series of trial landings and take-offs with a Viscount.

FALCON ORDERS.—Hughes Aircraft has received orders worth $65 million for production of Falcon air-to-air missiles between mid-1961 and mid-1962.

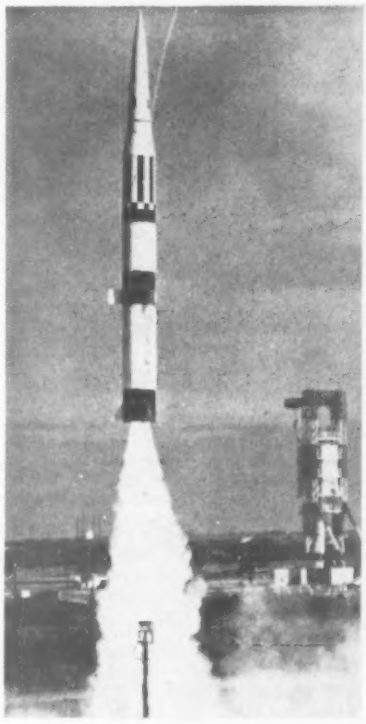
HILLER AIRCRAFT.—The Hiller Aircraft Corporation has been taken over as a subsidiary by the Electric Autolite Co. of Toledo, Ohio.

GLIDING RECORD.—Mrs. Anne Burns has established a new speed record for women over a 300-km. triangular course in South Africa. Flying a Slingsby Skylark she covered the 188 miles at an average speed of 42.25 m.p.h. The previous record, set up in Poland last July, was approximately 38 m.p.h.

INDIAN AN-12s.—Delivery of the eight Antonov An-12 turboprop transports to the Indian Air Force is expected to begin early this year. They are reported to carry a 36,000 lb. payload and will be used to fly constructional equipment and materials into the mountainous northern border region. The price is said to be about Rs. 10 million (£750,000) each.

SHACKLETON WEEK-END.—This year's sales week-end of light and executive aircraft by W. S. Shackleton (Aviation), Ltd., is to be at Baginton, Coventry, instead of Kidlington, between Apr. 28-30. Baginton is being made available by the Coventry City Council and is rather larger and, therefore, more suitable for the ever-increasing scope of this sales week-end.

LOCKHEED SALES.—During 1960 more than half Lockheed sales came from missiles and space projects. Polaris missiles accounted for 30% of sales and, in addition, more than 22% came from space research and sales of Agena satellite vehicles. Aircraft made up only 43% of total sales, compared with 94% in 1955, but in actual value aircraft sales declined only from $637 million in 1955 to $560 million in 1960.



EIGHT OUT OF NINE.—This U.S. Army Pershing SSM was launched from Cape Canaveral last month with a new inertial guidance system. During 1960 eight successful Pershing launchings were made in nine firings.

S-62 ORDERS.—A Sikorsky S-62 turbocopter has been ordered by the Fuji Airline Co. of Tokyo, for charter operations and to give turbine experience prior to the introduction of two Boeing Vertol 107-IIs also on order. The Indian Air Force recently took delivery of an S-62B, for use at high altitudes in the Himalayan Mountains.

INVALUABLE REFERENCE

TO be published on Jan. 18, by Temple Press, Limited, "*Plastics*" *International* is an entirely new and comprehensive guide to the products of the plastics industries of the World. Compiled and produced in conjunction with our associated journal *Plastics* it is a ready source of up-to-date information for consumer industries using any form of plastics materials. The book contains 488 pp., 240 half-tone and 15 line illustrations and is available from the publishers at Bowling Green Lane, E.C.1, price 63s.

ADVANCED ROCKET.—Pratt & Whitney are to develop a more powerful version of the LR-115 liquid oxygen/liquid hydrogen rocket motor, which currently gives 15,000 lb. of thrust. The advanced version will be known as the LR-119.

TIROS AID.—Information transmitted from the U.S. satellite Tiros II was used last week by Australian meteorologists to locate the centre of a tropical cyclone. The disturbance was approaching northern Queensland from the Coral Sea. Ground and aircraft reports were being co-ordinated with TV pictures obtained by the satellite as it passed over the cyclone area.

SATURN CRADLE.—Equipment necessary to transport, prepare and launch the 1.5m. lb. s.t. Saturn booster is now complete. Saturn's first stage (approximately 80 ft. long by 22 ft. dia.) will be cradled and dollied at Huntsville, Alabama, placed in a specially designed barge and floated down-river to New Orleans. Thence, the booster will be conveyed to a dock and check out station at Cape Canaveral, Florida.

NEXT SCOUT.—A second attempt to launch a Scout rocket into orbit will be made shortly from Wallops Island. It will carry the S-55 micrometeorite satellite.

TARGET DATES.—Following are revised target dates for major U.S. space programmes: Mars and Venus reconnaissance: 1962-64; Orbiting Astronomical Observatory: 1963-64; Flight test of Saturn-boosted Rover nuclear rocket: 1965-67; Flight test of Rocketdyne F-1 1.5 million-lb. thrust engine: 1963-65; and flight test of Apollo spacecraft: 1965-68. Developed versions: 1968-70.

SOLAR POWER.—The Radio Corporation of America has received a $95,000 contract from NASA for a research programme to investigate radiation damage to silicon solar cells used as a power source for satellites and space probes. In these tests, solar cells will be exposed to relatively low proton energies —below 40 mev.

MORE SCOUTS.—France, Germany, Italy, Japan and Australia are among countries negotiating with NASA to put instrumentation in Scout-launched satellites. Discussions are also taking place with Argentina, Norway and Sweden.

SPACE ANTENNA.—Hughes Aircraft has received a contract to study the construction of a space-tracking antenna 200 to 250 ft. in diameter. At present there are three deep-space instrumentation facility (DSIF) stations at Goldstone, California; Woomera, Australia; and Krugersdorp, South Africa, with tracking antennae 85 ft. in diameter. The advanced antenna would increase the DSIF communications ability by 10 to 30 times.

SAMOS SNATCH.—U.S. Air Force is to use five Lockheed C-130 transports for air-snatch recovery of Samos reconnaissance capsules which are larger than Discoverer capsules at present handled by nine Fairchild C-119s. Five Samos launchings are planned before firs. recovery attempt next autumn.

BIGGER ECHO.—NASA's Echo II balloon satellite will probably be 140 ft. diameter (as against 100 ft.) and use some form of sandwich construction to increase rigidity.

Commercial Aviation Affairs

B.O.A.C. PLANS.—The B.O.A.C. 1961 summer timetable shows that Boeing 707s will be introduced on the Central American routes to Caracas and Bogota in May. In June, a once-weekly 707 service between Port of Spain, Bermuda, New York and London will fly in B.W.I.A. colours, replacing the present Britannia service. Comets will replace Britannias to Aden from Apr. 1.

AIR INDIA BOEINGS.—Two more Boeing 707-420s are to be purchased by Air India, for delivery by March, 1962, according to Mr. J. R. D. Tata. By 1962, it is planned to operate, with the fleet of six Boeing 707s, a daily service to London and New York, twice a week to Tokyo and Nairobi and once a week to Moscow and Sydney.

B.U.A. TO LAS PALMAS.—Starting on Mar. 5, British United Airways will serve Las Palmas, Canary Islands, with a weekly scheduled Viscount service under a new licence. Tourist return fare will be £82. The service is additional to the B.U.A. "Safari" through Las Palmas, on which it already has traffic rights between the Canaries and West Africa.

EL AL 707.—From the beginning of the year El Al has been operating a weekly Lydda-New York service with a Boeing 707-420 chartered from Varig. The frequency will be doubled on Feb. 19 and doubled again in June when delivery will be made of El Al's own two 707-420s.

FRIENDSHIP DELIVERY.—The first of five F-27As ordered from Fokker by Pakistan International Airlines was handed over on Jan. 3 at Schiphol, and left for Dacca on Jan. 6.

B.O.A.C. IN 1960.—An increase of 31.4% in the number of passengers carried is reported by B.O.A.C. in 1960. Passenger-miles increased by 29.3%; freight short-ton miles by 7.9% and mail by 22.1%; capacity ton-miles by 26.2%; revenue aircraft miles by 20.7% and revenue aircraft hours by 7.9%.

G. E. CARAVELLE.—On Dec. 29 the Sud-Aviation Caravelle bought by General Electric made its first flight powered by two G. E. CJ-805-23 turbofans. It will be used as a demonstrator for the Caravelle 7 which will have two of these aft-fan engines.

T.C.A. PROGRESS.—Passenger miles flown by T.C.A. in 1960 increased by 8.5% to 2,000 million at an average load factor of 66%. Revenue ton-miles increased by 11%, air freight by 15%, air express by 7.6% and mail by 2.3%. Economy-class service has been introduced on all North American routes, with all T.C.A. Viscounts converted to 54-seaters. The new sliding-scale fares related to distance were introduced on Jan. 2, and Vanguards will go into service on Feb. 1.

K.L.M. IN 1960.—Capacity offered by K.L.M. in 1960 increased by 15%, and a slightly greater increase in revenue ton-miles performed pushed the load factor up by 0.4% to 59.7%. The number of passengers carried increased by 23%, freight by 20% and mail by 14%. The last Electra was delivered in December and five more DC-8s are to be delivered this year.

SAN FRANCISCO HELICOPTERS.—Two Sikorsky S-62 turbocopters have been leased from the makers by San Francisco-Oakland Helicopter Airlines, which will inaugurate scheduled service on Apr. 1 to serve San Francisco and Oakland airports and downtown Oakland, San Francisco, Berkeley and Palo Alto. A third S-62 may be acquired later, followed by an S-61 "when traffic load factors make such an operation economically feasible."

ELECTRAS FOR BRAZIL? — Four Lockheed Electras are to be purchased by the Brazilian Loide Aereo for domestic operations, according to Sr. Antonio Gonzales, the general manager. The first two—furnished as 74-seaters—will be delivered this year.

K.L.M. TO LAGOS.—K.L.M. will include Lagos in a once-weekly Super Constellation service between Amsterdam and Accra from Jan. 17.

DAN-AIR FARE CUTS.—Domestic fares on Dan-Air services routes have been cut by up to 24% from Jan. 1. The reductions might have been more had it not been for the planned landing-fee increases (see our issue of Dec. 16, p. 790) which are likely to apply to municipally as well as State-owned airports.

CORPORATION STRIKES. — Both B.E.A. and B.O.A.C. were forced to cancel all flights out of London Airport on Jan. 5 as a result of a dispute with the ground engineers. Some 2,800 engineers went on an unofficial four-hour strike on Jan. 4 and were subsequently suspended for a day. Later, the unions accepted a pay increase of 3d. an hour which had been offered by the Corporations earlier in the week.

PILOTS REQUISITIONED. — More than 200 Air France air crews who had been on strike since Dec. 8 were requisitioned by the French Government on Dec. 27, and Boeing 707 services were resumed on that day. The requisitioning order, placing the personnel on a military basis and liable to military prosecution, followed their refusal to obey an earlier Government order to go back to work pending settlement of their grievance over a cut in pay which accompanied an agreed reduction in working hours. Because of the Government action, all other Air France crews struck for 24 hours on Jan 2, until they too were requisitioned.

CARIBOU POWER.—An engine nacelle mock-up for the de Havilland Canada turbine-powered Caribou. Flight testing of the General Electric T64 turboprop will start in May and more than 240 hr. is to be logged on two test engines during the initial phase.

ALL-JET T.C.A.—From Jan 2, T.C.A. has been operating DC-8s exclusively on all its services to Europe; the last trans-atlantic flight by a T.C.A. Super Constellation was on Jan. 1, from London.

IATA MEMBER.—Cunard Eagle Airways (Bermuda), Ltd., has become a full member of IATA, in addition to the parent Cunard Eagle Airways, Ltd., in London. Linea Aeropostal Venezolana, having ceased international operations, is no longer an IATA member.

IATA CLEARING HOUSE.—International airline business settled through the IATA clearing house in London in the first three months of 1960 increased by 32%, to a total of £401 million.

ELECTRA UNRESTRICTED.—The F.A.A. has approved the modifications of the Electra and has lifted the speed restriction, imposed last March, for the modified aircraft. Three of the 96 Electras in service have been modified to date.

VASP TO EUROPE?—According to the president of VASP, Brigadier Osvaldo Pamplona Pinto, this Brazilian domestic operator plans to extend its operations to Europe this year. He also mentioned interest in the Vickers VC10 for eventual use on these routes.

FAIL-SAFE F-27.—The F.A.A. has recently declared the centre wing section of the Fairchild F-27 to be a fail-safe component. Hitherto it had been regarded as a safe-life component requiring to be replaced after 7,600 hr. in use. The safe-life of the F-27 fuselage has been increased to 40,000 hr.

FINE FOR FEATHERING?—Invoking a rarely used statute, the U.S. Government is seeking $1,000 damages from a Western Air Lines pilot who is accused of feathering the wrong propeller on a flight from San Francisco last July. The aircraft returned and landed safely.

FINNAIR ACCIDENT.—All on board —22 passengers and a crew of three— were killed when a Finnair DC-3 on a domestic service crashed at Koivulahti on the N.W. Finnish coast on Jan. 3.

News About People

TOTAL CONTROL.—At a Press conference in Rio recently; Sir Matthew Slattery, chairman of B.O.A.C., has Mr. M. A. Snowball on his left. As we announced last week "Tony" Snowball has assumed managerial control of the whole of B.O.A.C.'s effort in South America.

C.G.A. APPOINTMENT. — Mr. T. H. Farnsworth, former chief of flight operations, B.O.A.C., is joining Curtis Greensted Associates, Ltd. He will be mainly concerned with the technical aspects of the services C.G.A. provide for manufacturers, operators and users of business aircraft.

E.M.I. DIRECTOR. — Air Vice-Marshal W. E. Oulton has joined the board of E.M.I. Electronics, Ltd., as director responsible for Ministry work.

VICKERS CHANGES.—Mr. J. Ferguson Smith, a special director of Vickers-Armstrongs (Aircraft), Ltd., has been appointed deputy general manager at Weybridge. The company's engineering manager, Mr. J. A. Pull, has become a special director.

HUNTING CHAIRMAN.—Now that Sir Percy Hunting has retired he has been succeeded as chairman of Hunting Aircraft, Ltd., by Sir George Edwards. Mr. G. L. Hunting, Sir Percy's brother, becomes chairman of the Hunting Group of companies.

LANSING BAGNALL NEWS.—Mr. A. Potter has been appointed general sales manager of Lansing Bagnall, Ltd.; he joined the company in 1956 as personal assistant to Mr. J. R. Sharp, the joint governing director and has been overseas manager since March, 1959. The company has also announced that Mr. E. H. Wheeler has been appointed export sales manager; and Mr. C. A. Barr becomes manager of the technical services division.

M.o.A. APPOINTMENTS.—Air Cdre. F. W. Thompson, C.B.E., D.S.O., D.F.C., A.F.C., has been appointed director of guided weapons (trials) at the Ministry of Aviation to succeed Air Cdre. W. R. Brotherhood. Air Cdre. H. Russell, O.B.E., has been appointed director of R.A.F. research and development/B to succeed Air Cdre. W. D. Distrey, C.B.E., A.F.C.

CAPT. THAIN.—An appeal by Capt. James Thain against the B.E.A. decision to dismiss him following the report on the Munich Elizabethan accident, has been rejected by the National Joint Council for Civil Air Transport.

SMITHS APPOINTMENT.—Mr. J. P. Castrey has joined the technical sales staff of Smiths Aviation Division at Kelvin House, Wembley.

RACAL PUBLICITY.—Mr. R. M. Lustig has joined Racal Engineering, Ltd., as publicity officer in charge of the company's publicity department.

STEEL APPOINTMENTS.—Mr. A. Broomhead has become deputy managing director of Thos. Firth and John Brown, Ltd. Mr. F. Wortley, a director of the company, has been appointed general works manager.

HUNTING BOARD.—Mr. W. A. Summers, C.B.E., and Mr. K. D. Morgan, directors of Hunting Aircraft, Ltd., have resigned from the boards of Hunting Aviation Management, Ltd., Hunting Engineering, Ltd., Hunting Mhoglas, Ltd., and The Henderson Safety Tank Co., Ltd.

AUTOMOTIVE PRODUCTS.—Mr. A. W. Turner, general manager of The Automotive Products Group, has become local director of Lockheed Precision Products, Ltd., at Speke.

B. H. C. APPOINTMENTS. — Mr. M. A. L. Banks, Mr. A. F. McDonald and Mr. R. B. Southall, C.B.E., have been appointed to the board of British Hydrocarbon Chemicals, Ltd., and Mr. C. E. Evans, O.B.E., has been appointed managing director.

DUNLOP RETIREMENT.—Mr. L. W. Tingle, commercial manager of the Aviation Division of the Dunlop Rubber Co., has recently retired after 49 years' service with the company.

G. M. BELLANCA.—The death has occurred in New York of Giuseppe M. Bellanca at the age of 74. He was designer of the Wright-Bellanca monoplane "Colombia," which carrying Chamberlain and Levine flew (42 hr.) non-stop from New York to Eisleben in 1927. (Jne. 4-6.)

GNOME CONTRACT.—Signing of the £1 million contract for the supply of Gnome turbine engines to the Agusta Company of Milan reported in our issue of Dec. 30, 1960. Mr. Hugh Buckingham, managing director of the de Havilland Engine Co., is in the middle and on his left Signor Domenico Agusta, president and general manager of Costruzioni Aeronautiche Giovanni Agusta.

Personal Flying

IN the December issue of the travel magazine "Go" is a special feature, written by poet-pilot John Pudney, on the facts of flying for the private owner or the airborne executive. A representative range of modern and less-modern aircraft is shown, together with samples of current prices, and there is also a limerick competition, sponsored by W. S. Shackleton, Ltd. This was for a suitably aviation-orientated limerick, and the prize was an opportunity to learn to fly free of charge. Closing date for entry was December 30.

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Nipper news from Belgium is that by late 1960, more than 40 of these sprightly single-seaters from Avions Fairey were flying throughout the World. Of this total, 13 were in Belgium, one in South Africa, 11 in Denmark, one in Austria, one in Germany, two in Australia, one in Sierra Leone, two in Italy, one in Nigeria, two in the U.S., one in Luxembourg, one in the Congo, one in Switzerland, and four in Britain. The last-mentioned are G-APYB, 'RFV, 'RBP and 'RDY.

Production is continuing for the moment at Gosselies, where orders are outstanding for 50 more Nippers for Denmark, 11 for Nigeria and 10 for Ghana. Reports, however, indicate that Nipper construction in Belgium may cease after the current orders are fulfilled, because of Avions Fairey preoccupation this year with F-104G production. The possibility has been discussed of transferring Nipper production to the United States, where a potential market for about 1,000 of these ultra-lights is believed to exist, and the name of Kaman has been mentioned as a licensee.

A prototype Nipper has flown with a new Belgian aero-engine built by the Fabrique Nationale factory, which is responsible for the J79 turbojets in the F-104 programme. No power has been mentioned for the new engine, which, however, is said to be destined for a two-seat development of the Nipper, currently known as the Bipper.

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Nominations are required by the British Women Pilots' Association for the Jean Lennox Bird Trophy and the Brabazon Cup, for the year ended Dec. 31, 1960, from anyone with an interest in aviation. Candidates must be British women pilots with at least a student licence or a gliding "B" certificate, and nominations, with full details of name, licence category, flying experience and achievement, must be received by the BWPA, c/o Miss M. Woodall, 3 St. James's Gardens, London, W.11, before Jan. 31.

The Jean Bird Trophy is for a series of achievements, such as rapid training progress or the gaining of a number of qualifications, etc., while the Brabazon Cup is for a single outstanding feat.

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Flair-Aviation Sales of Bromley has been appointed sole distributor in the U.K. for the Putzer and Klemm-Bolkow aircraft companies of Bonn and Munich. Both German companies produce aircraft suitable for club, private and executive flying. Prices range from £2,750 for the two-seat Putzer Elster, to £3,500 and £4,900 for the three- and four-seat Klemm-Bolkow aircraft.

Examples of each of these types will be brought to the U.K. in early spring for A.R.B. certification and demonstration flying. A range of spares will be carried by Flair-Aviation for the optimum after-sales service, and replacement of mainplanes, fuselage and larger parts can be arranged within 48 hours.

In addition to the two agencies, the British company will deal in the sale of second-hand British and American aircraft, the latter through the Norman Larson company of Van Nuys, California.

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R. K. Dundas, Ltd., the aviation brokers, of 59 St. James's Street, S.W.1, have been appointed by Jeppesen and Co., of Denver, U.S.A., as dealers for all their products. They have already supplied quite a number of the various available manuals to British pilots.

For the private pilot, Dundas recommend the Radio Air Route Guide since this gives coverage as far as 72° N., 25° S., 10° W., and 44° E., which takes in the whole of the U.K., Europe, the Near East, and North Africa. In addition to the comprehensive aviation charts, it includes area charts for all major terminals, an airport directory, provision for approach charts, tables and codes, meteorology, radio facility, and air traffic control sections, ICAO and national regulations, entry requirements, and an emergency section, plus a plastic plotter.

A simple but comprehensive weekly revision service is provided for a 10-minute maximum amendment time. Cost is £19 12s. 6d. including the first year's revisions, plus a service from Jeppesen and Co., for procurement, hire or borrowing of further charts and sections, etc. All other manuals are basically similar, but with full IFR and all airport approach coverage. They are used by 92% of all commercial airlines in the U.S.A., many international airlines, more than 85% of American business and executive pilots, and by the U.S. Army.

Gliding Notes

by Dr. A. E. Slater

"A GENERAL characteristic of the atmosphere is its streakiness." This introduction to an article by Joachim Kuettner in a recent issue of *Tellus* reminds one of Kipling's lighthouse keeper in his story "The Disturber of Traffic" (from "Many Inventions"), who was driven off his head by the constant sight of streaks left by steamships passing through the Flores Strait east of Bali. Perhaps, one day, a watcher from a manned satellite will become similarly obsessed by the constant succession of cloud streaks passing below. However, Kuettner drafted his article before the first Tiros weather satellite went up, and we now know that the streaks tend to be spiral rather than straight, and are often subdivided by secondary patterns.

Kuettner deals mostly with cloud streets, and gives one hour's duration, 50 km. length, and 5 to 10 km. spacing "from axis to axis" as typical, though he adds that they are sometimes several hundreds of km. long. However, I doubt if any length can be called typical for a cloud street, and most of them, according to my observation, are much shorter than this, especially during the first hour or so after they have begun to form.

In fact, I have a strong suspicion that the length, and particularly the duration, varies during the day as the sun moves round. For instance, when a cloud street is overhead of its own shadow, or the shadow of a neighbouring street, it should tend to dissipate through lack of thermals to feed it from below.

When the edge of the shadow is directly under the centre of the street, one would expect only one side of the street to be invigorated. This is actually what happened on that notable day, Jly. 30, 1935, when four German pilots simultaneously broke the World's distance record with 313 miles from the Wasserkuppe to Brno in Czechoslovakia.

The account by one of them, Ernst Steinhoff, is reproduced in *Tellus* and describes how he approached his first street from the north through a down-draught which became increasingly strong until he had passed under the street to a point beyond its centre-line, and he only found good lift near its southern border. As he climbed, the wind increased to 75 m.p.h. at 12,000 ft. and he reckons that, flying straight, he covered about 110 miles in half an hour.

However, it is not quite correct to say, as Kuettner does, that Steinhoff "encountered and recorded this interesting phenomenon for the first time in flight history." Cloud streets were included in the glider pilot's vocabulary from 1931 onwards, and earlier, in 1928, Robert Kronfeld used a continuous line of clouds to return from the Himmeldankberg to the Wasserkuppe when making the first cumulus-thermal soaring flight in history.

Unfortunately for those sailplane pilots who occasionally express an ambition to soar across the Atlantic by the trade-wind route, using the characteristic streets of cumulus to be found there, Kuettner once measured the lift produced by one of these streets by flying a B-29 along it at 1,000 ft., and found the lift along it to average 1 m./sec., using as a datum the air between the streets, which was probably going down, anyway. This hardly gives much margin to allow for irregularities in the lift distribution. At 3,000 ft., however, he found localized upcurrents of up to 4 m./sec. inside some portions of the individual clouds.

Some years ago, Kuettner discovered that, usually, in the presence of cloud streets, the wind in the convection layer is at its strongest not at the top of the layer but some way down, usually about the level of cloud base. But now he produces some examples of "low level jets" in which the wind shows a very sharp maximum at only 500 or 600 ft. above the ground. This, he suggests, is explained by the pressure gradient being strongest at ground level, due to the synoptic situation. However, the "jet" is so shallow that one suspects some other cause.

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London Gliding Club announce that its annual dinner/dance will be on Feb. 25.

Correspondence

The Manpowered Helicopter

I AM interested in the report (Dec. 16) on Mr. Beverley Shenstone's MAPAG lecture at Southampton and particularly impressed by his opinion that "There is practically no hope for rotating wings."

There can be no question of the speaker's knowledge on the subject but I suggest that he might have qualified his remark with some such phrase as, "under present known conditions." But then the remark might apply equally well to all form of manpowered aircraft.

It seems to me that the margin between failure and potential success is so narrow that we shall have to find "something new" in the way of obtaining high lift at low speed before controlled flight by manpower alone is practicable.

Some years ago I designed a rotary blade which I believe incorporates this desirable feature and, if I had not run short of spare cash, would have had my flying test rig ready by now.

Whilst it is true in general that higher powers are needed for helicopters than fixed-wing aircraft, the autogyro with powered take-off does, I suggest, make the best use of the energy available, firstly in getting airborne and then translating to forward flight. The gyro-cyclist can adjust his angle of attack at will, build up inertia in his blades, tilt his rotor to assist his propeller in rolling take-off or he can avoid ground friction entirely and take advantage of "ground effect" in a jump-start while the fixed-wing man has either to divide his energy between propeller and ground wheels or put up with the inefficiency of his airscrew at very low speed while exerting himself to the full.

He *must* propel himself forward to attain flying speed although the gyro-cyclist can give his rotary wings airspeed whilst standing still or proceeding slowly forward. The latter being the easier for obtaining lift.

To give an example of the ultra-small craft, a 21-ft. diameter rotor, revolving at the same rate as the pedals, say, 1½ rev. per sec. (90 r.p.m.), has a tip velocity of 67½ m.p.h.—an average of nearly 34 m.p.h. over its length (or should I say radius?). Agreed, the "losses" are greater than with a fixed wing of similar dimensions but the drag is the same and surely it is far easier to attain that rate of rotation through a train of gears than to propel an aircraft forward at about *the same speed as a sprinting track cyclist* who has to propel, at most, a quarter of the weight and frontal area.

Changing the gear ratios is but a few minutes' work but finding the optimum rotor dimensions by trial and error is likely to be expensive.

Brixton, London, S.W.2. H. R. BARNARD.

Air Traffic Control Anomalies

THE recent appalling tragedy in America caused by the air collision of two large aircraft over a major city appears to arouse one common reaction in this country . . . "it could never happen here." But couldn't it?

Considering the congestion of population in large cities today, is it not reasonable to think that the Americans were indeed fortunate in not suffering a much higher number of casualties among people on the ground and in buildings? Even the Munich air crash which followed did not reap such a high number of victims as could occur if any one of our modern gigantic blocks of human concentration were to be hit by a large airliner.

Several questions come to mind as a result of the present "policy" of increasing the size of passenger aircraft, and "stacking" them over densely populated areas while waiting to land:—

(a)

Is it not a fact that any similar incidents in the future will involve progressively more lives?

(b)

Has not the point been reached when someone with real courage should insist that major airports must be situated well out of heavily built-up areas, and a *really* fast method of transport to the centre of cities be installed? Monorail for instance. Surely the comparatively small increase in travelling time must be accepted as the only sure safeguard against a major disaster?

(c)

I am informed that an aircraft in trouble over the United Kingdom—including any of our major cities—should call for assistance on an International Distress Radio Frequency. In this country this frequency is under the control of the Royal Air Force and its air traffic control system, the qualifications of whose control officers are not recognized by the Ministry of Aviation; this, in spite of the Ministry's comparative lack of experience in the field of Air Traffic Control, and especially the handling of intensive jet traffic.

When the true history of Regional Flying, and now Air Traffic Control comes to be published in the not too distant future, it will be seen that what originated in the United States as a Meteorological Advice Service in the 1920s was not accepted or developed in Great Britain until the appalling losses of aircraft and crews during the recent War had broken down the massive official opposition to the idea of a man on the ground telling a pilot something he did not know. The vast experience gained by the R.A.F. in the handling of large numbers of aircraft in safety during and since the War has been lost to a great extent due to the peculiar policy of the Ministry of Aviation. This "closed shop" mentality has for years shown itself in the weekly advertising for Air Traffic Officers and at the same time consistently refusing to accept the qualifications of experienced Control Officers leaving the R.A.F., to quote—"there being no shortage of young civil pilots."

Surely the time has come for a realistic approach to Air Traffic Control in this country and for Military and Civil

Wroundabout

Happy Days. Browsing through Charles Sims' "Camera in the Sky" I came across his note of 800 Sqn.'s unusual mixed equipment, in 1932, of Osprey recce-bombers and Nimrod fighters. This recalls to me the period, around 1935, when my own old bomber squadron, 604, was changed to the fighter rôle but still used its Westland Wapiti bombers pending delivery of Hawker Demons. So it was that in that year's Air Exercises, the Wapiti helped defend these islands. Armed with one forward-firing Vickers and one Scarff-ring-mounted Lewis, it took about 20 minutes to reach 15,000 feet and when it got there it could fly at around 120 m.p.h.

*

The New Biology. "Directors of the Air Line Pilots Assn., deadlocked for four days over what to do with flight attendants, have decided to form a separate stewards' and stewardesses' division linked to ALPA only by a common president."—*Aviation Week.*

*

Line Shot

Two R.A.F. Hunters flying over Germany. The pilot of one gets a broadcasting station's music encroaching on his wave-band. He calls the other Hunter: "Blue Two—have you got a musical background?" Blue Two: "Well, my grandmother played the harmonium a bit."

*

Smug Smile Dept. Nice to see that Short's and the R.A.F. have heeded the Wroundabout tip (Jan. 29, 1960) about the likely confusion between Britannia and Britannic and have changed the latter's name to Belfast. This is what is known as the Power of the Press. In a word, Wrepression.

*

by Wren

qualifications to be recognized by both sides? After all, the Royal Air Force taught the original controllers of civil aviation. Perhaps the introduction of a Unified Control Organization is long overdue?

(d)

There is little intensity of air traffic today over England compared for instance with that at major airports in the U.S.A. (London Airport aircraft movements are about the same as small airports rated between 70th and 80th in intensity in America.) This traffic must obviously increase several times over. Can anyone honestly state this has been planned for with the safety factor foremost in mind? I very much doubt it—despite the official assurances from our several Ministers of Aviation in the past few years, who have been so busy closing down airfields.

Incidentally, the timing of the recent announcement regarding "secondary radar" is admired but does nothing to reassure aeronautical circles who are quite aware that it is not a "new" device.

I also see that the latest issue of Janes, "All the World's Aircraft" still describes Air Traffic Control as a "nightmare"! Perhaps the only solution would be to wake the "sleeper" . . . but not *too* gently?

Brockworth, Gloucester. "AIRSAFE."

Fatality Rate Statistics

MR. A. H. CRAWSHAW, in his letter on "Fatality Rate Statistics" (Jan. 6) has erred in his comparative statistics. One does not argue with his assumed average speeds for U.S. cars, taxis, buses and trains (although wondering how he arrived at them), but one does argue with him when he compares a ground accident rate in terms of *passenger* hours with an air rate in terms of *aircraft* hours.

The aircraft figure of 330 quoted by Mr. Crawshaw is the accident rate per 100 million aircraft hours in 1959 (from the ICAO statistic of 0.33 per 100,000 aircraft hours). It is still necessary to convert this figure, for a fair comparison, to *passenger* hours. The average number of passengers per aircraft in 1959 was 32, so the fatality rate then becomes 10.3 per 100 million passenger hours.

This is the World figure for 1959, with which Mr. Crawshaw compares the U.S. surface transportation accident rates averaged for the years 1948-1957. A strange basis for fair comparison, even though the point Mr. Crawshaw is making is no doubt true. Another "hidden" factor in these statistics, incidentally, is the greater average trip distance in air transport—which means the accident risk per passenger hour is spread over fewer individuals.

Hayes, Kent. F. G. SWANBOROUGH.

Air-minded Alleynians

IN reading the obituary, in your columns (Dec. 30 last), of Professor W. J. Duncan's education at Dulwich College, I was struck by the number of men prominent in aeronautics who were educated at that school. Other Old Alleynians who spring to mind are Capt. J. L. Pritchard, Wg. Cdr. T. R. Cave-Browne-Cave and Maj. P. L. Teed. There are, doubtless, others with whom I have not had contact.

London, W.1. "OLD BLUE."

Publications Received

Upper Winds Over the World, Parts I and II. By H. Heastie, M.Sc., and P. M. Stephenson, M.Sc. This is a new edition of Geophysical Memoir No. 103, first published in 1950, and now very much enlarged in scope. Charts covering the whole of the World (except Antarctica) show average winds at six standard upper levels from 700 to 100 millibars (approx. 10,000-52,000 ft.) for the months of January, April, July and October in the period 1949-53. Charts of standard vector deviation, to show wind variability, will be published separately in Part III. 220 pp.; 8½ in. by 11 in. Illustrated. H.M. Stationery Office. Price 30s.

Handbook of Aviation Meteorology. By A. F. Crossley and others of the Meteorological Office staff. Intended primarily for the use of pilots and navigators (military and civil) at the intermediate and advanced stages of instruction in flying training schools, this work has a much wider appeal to all concerned with the application of meteorology to aviation. Theory, practice and application are covered and the salient features of weather over the World and on the trunk air routes are briefly described. 420 pp.; 6 in. by 9¾ in. Illustrated. H.M. Stationery Office. Price 25s.

F. W. Lanchester—The Life of an Engineer. By P. W. Kingsford. A necessary biography setting out the life, work and achievements of one of the great British pioneers of aeronautical and automotive engineering, whose grasp of fundamental and aerodynamic problems has been described as "an advance as notable as that of the Wrights." 246 pp., 5½ in. by 8½ in. Illustrated. Edward Arnold (Publishers), Ltd. Price 30s.

Energy Theorems and Structural Analysis. By J. H. Argyris, D.Sc.(Eng.) and S. Kelsey, B.Sc.(Eng.). A series of articles which first appeared in *Aircraft Engineering* in 1954 and 1955, now reprinted in book form to meet the continuing demand for information on the fundamental energy principles of analysis of elastic structures, and the matrix methods of analysis. 88 pp.; 9½ in. by 12 in. Illustrated. Butterworth and Co. (Publishers), Ltd. Price 21s.

Satellites and Space Travel. By J. W. R. Taylor and Maurice Allward. A new title in the well-known ABC series, providing a useful quick reference to the satellites and space research vehicles launched or planned to date. 64 pp.; 4½ in. by 7½ in. Illustrated. Ian Allan Organisation. Price 3s.

Space Biology. By James S. Hanrahan and David Bushnell. Deals with the physiological and psychological problems of space flight and their proposed solution. The authors are scholar-historians at the U.S.A.F. Holloman Base in New Mexico. 272 pp.; 6 in. by 9½ in. Illustrated. Thames and Hudson, Ltd. Price 35s.

Translation from Russian for Scientists. By C. R. Buxton and H. S. Jackson. A linguistic text-book designed to give the scientist and technician an adequate reading knowledge of the Russian language. 320 pp.; 5½ in. by 8¼ in. Blackie and Son, Ltd. Price 30s.

Aero Modeller Annual 1960-61. Compiled and edited by D. J. Laidlaw-Dickson and C. S. Rushbrooke, F.S.M.A.E. Indispensable hand-book for flying model enthusiasts. 160 pp.; 5½ in. by 8½ in. Illustrated. Model Aeronautical Press, Ltd. Price 10s. 6d.

The R.A.F. Athletic and Games Handbook. Winter, 1960-61. Information for keen Service types. 400 pp.; 4½ in. by 7 in. R.A.F. Sports Board, Air Ministry. Price 4s.

Two Hundred Precious Metal Years. By Ronald E. Wilson. This handsome volume tells the story of the Sheffield Smelting Co., Ltd., from 1760 to 1960, a company which has been primarily engaged in the treatment of gold, silver, platinum, other precious metals and non-ferrous metals for the whole of that time. 316 pp.; 5½ in. by 9 in. Illustrated and with end-plate maps. Ernest Benn, Ltd. Price 3 gns.

Aviation Calendar

Jan. 14

London.—British Interplanetary Society lecture, "Visual Observations of Earth Satellites by Individual Observers," by K. Fea, in the Kent Room, Caxton Hall, S.W.1, at 18.00 hrs.

Jan. 16

Amesbury, Wilts.—R.Ae.S. Boscombe Down Branch lecture, "Human Elements of High Speed Flight," by J. E. Gabb, in the Lecture Hall, A. and A.E.E., at 17.30 hrs.

Coventry.—Lanchester College of Technology lecture course in Rocket Engine Technology, "The Characteristics and Uses of Rocket Engines," by S. Allen, at the College, at 19.00 hrs.

Jan. 18

London.—R.Ae.S. Agricultural Aviation Group lecture, "Locust Control from the Air," by Dr. R. C. Rainey, in the Lecture Theatre, 4 Hamilton Place, W.1, at 19.00 hrs.

Jan. 19

London.—Institute of Physics lecture, "Some Physical Problems in Travelling at Supersonic Speed," by F. P. Bowden, in the New Hall, Royal Horticultural Society's Halls, Westminster, at 17.45 hrs.

Southampton.—R.Ae.S. Branch Main lecture, "Trends in Aircraft Propulsion," by H. Pearson, in the Lecture Theatre, Southampton University, at 10.00 hrs.

Jan. 20

London.—R.Ae.S. Man Powered Aircraft Group lecture, "Gliding and Man Powered Flight," by Lorne Welch, in the Lecture Theatre, 4 Hamilton Place, W.1, at 19.00 hrs.

London.—Institute of Navigation lecture, "Presentation of Height Information in Aircraft," by A. Stratton and K. R. Monick, at the Royal Geographical Society, 1 Kensington Gore, S.W.7, at 17.15 hrs.

Company Notices

NEW COMPANIES

EXECUTIVE HELICOPTERS, LTD. (677,670).—Private co. Reg. Dec. 13. Cap. £100 in £1 shs. Aircraft owners and operators, etc. Directors: R. H. Murray-Philipson, 20 Cottesmore Gardens, W.8; J. M. Baldock, 57 St. Georges Square, S.W.1; P. M. B. Nutting and T. M. Clutterbuck. Sec.: E. R. W. Dent. Sols.: Pennington and Son, 64 Lincoln's Inn Fields, W.C.2.

H. T. NEWTON AND CO., LTD. (678,500).—Private co. Reg. Dec. 21. Cap. £10,000 in £1 shs. Manufacturers of and dealers in aircraft, rockets and missiles. Directors: H. T. Newton and Mrs. Mary Newton, both of Settlefield, Hookwood, near Horley. Sec.: P. W. Smith. Reg. off.: Gatwick Airport, Horley.

TYNE TEES AIR CHARTER, LTD. (678,528).—Private co. Reg. Dec. 21. Cap. £25,000 in £1 shs. Directors: Chulam Mohammed, 1 Runnymede Road, Ponteland; G. F. Clay, 25 Darras Road, Ponteland. Sec.: G. Whitehead. Reg. off.: 18 Westmorland Road, Newcastle upon Tyne, 1.

INCREASE OF CAPITAL

Vigors Aviation, Ltd. (630,896).—11 St. James's Square, S.W.1. Increased on Apr. 28, 1960, by £119,000 in £1 ordinary shares, beyond the reg. cap. of £1,000.

CHANGE OF NAME

Fison-Airwork, Ltd. (552,382).—To acquire aircraft for use in connection with the destruction of pests, etc. Airwork House, 35 Piccadilly, W.1. Name changed to Airwork (Helicopters), Ltd., on Jne. 16, 1960.

Personal Notices

BIRTHS

Bowring.—On Dec. 28, at Wright Patterson Air Force Base Hospital, Dayton, Ohio, to Irene (*née* Rance), wife of Wg. Cdr. J. I. R. Bowring—a daughter.

Palmer.—On Dec. 23, at Purey Cust Nursing Home, York, to Maureen (*née* Buchanan), wife of Sqn. Ldr. Alan V. E. Palmer—a daughter.

Stirrup.—On Dec. 25, at Avonside Hospital, Evesham, to Sheila, wife of Sqn. Ldr. Jack Stirrup—a daughter.

DEATHS

Buff.—On Jan. 2, Air Cdre. Kenneth Caron Buff, O.B.E.

Hill.—On Jan. 2, Sqn. Ldr. Charles B. Hill, M.B.E.

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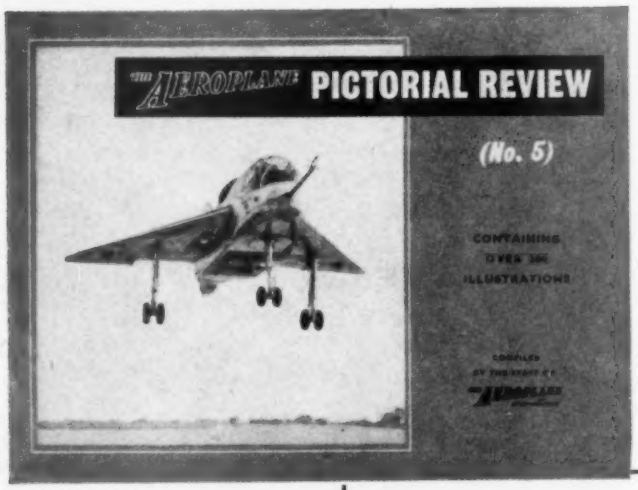

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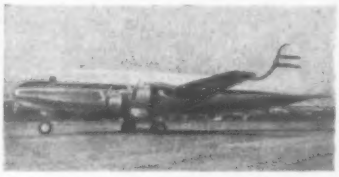

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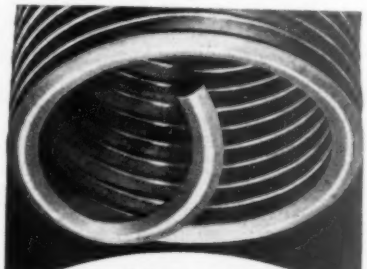

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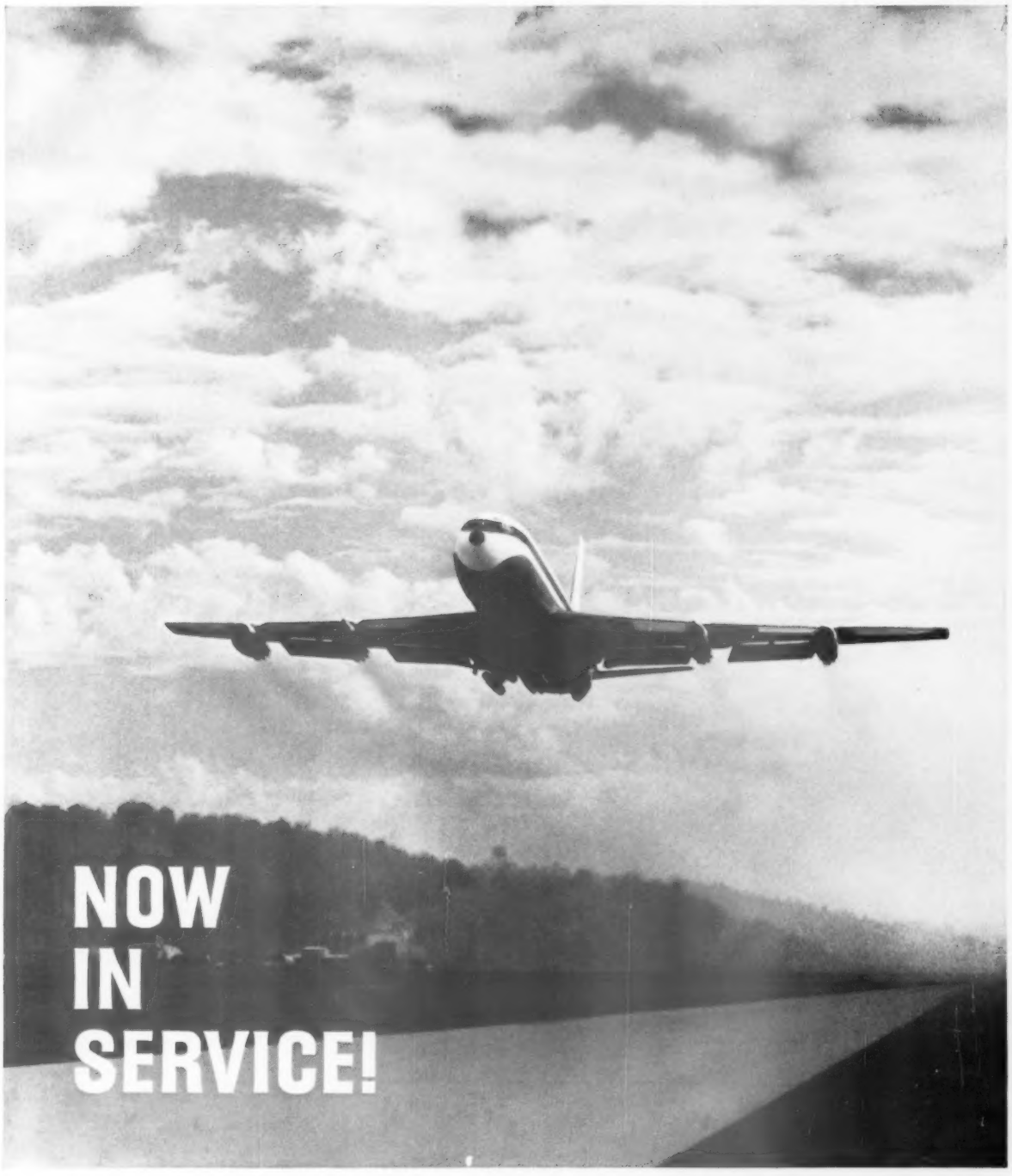

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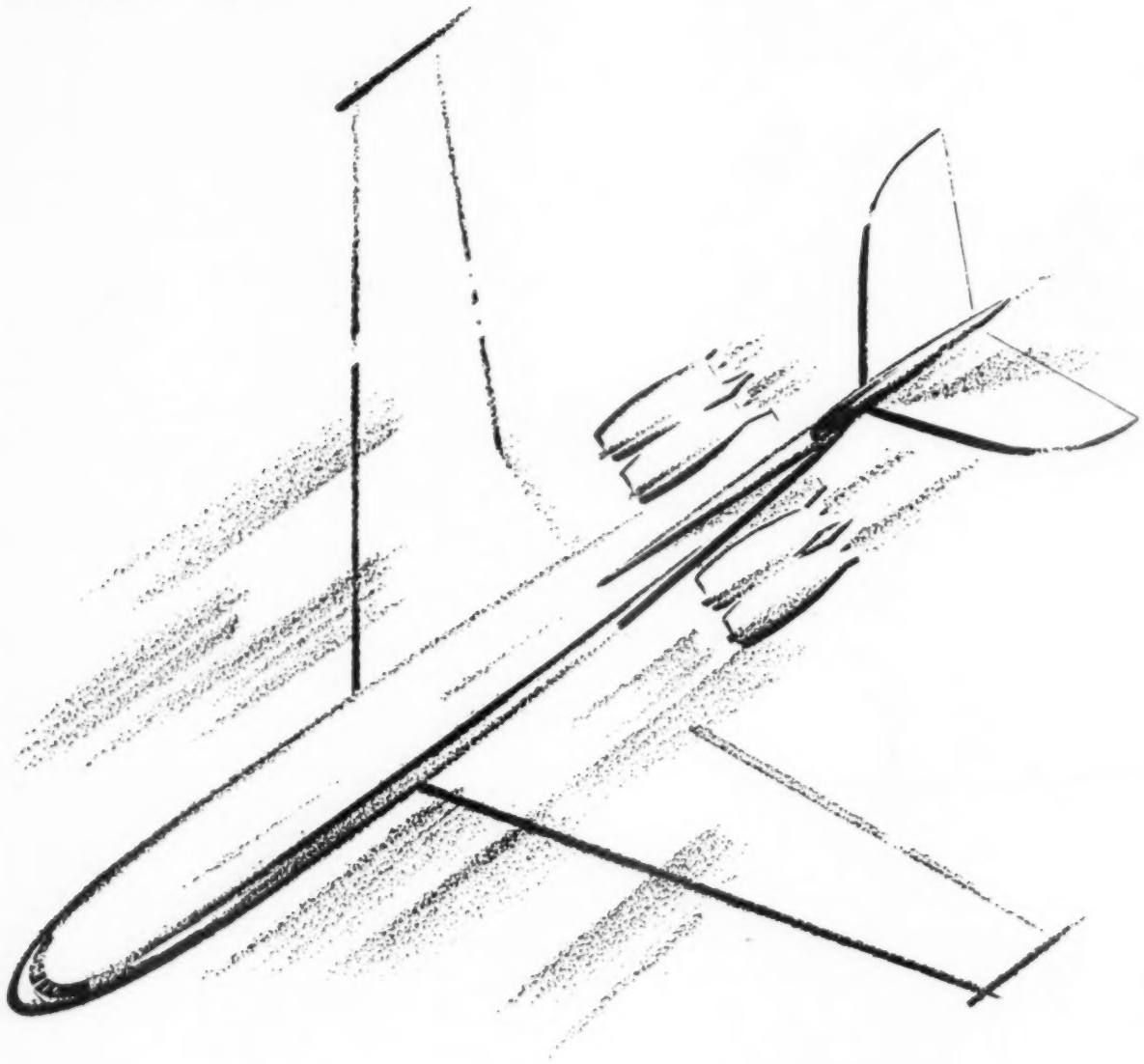

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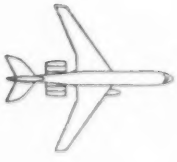

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